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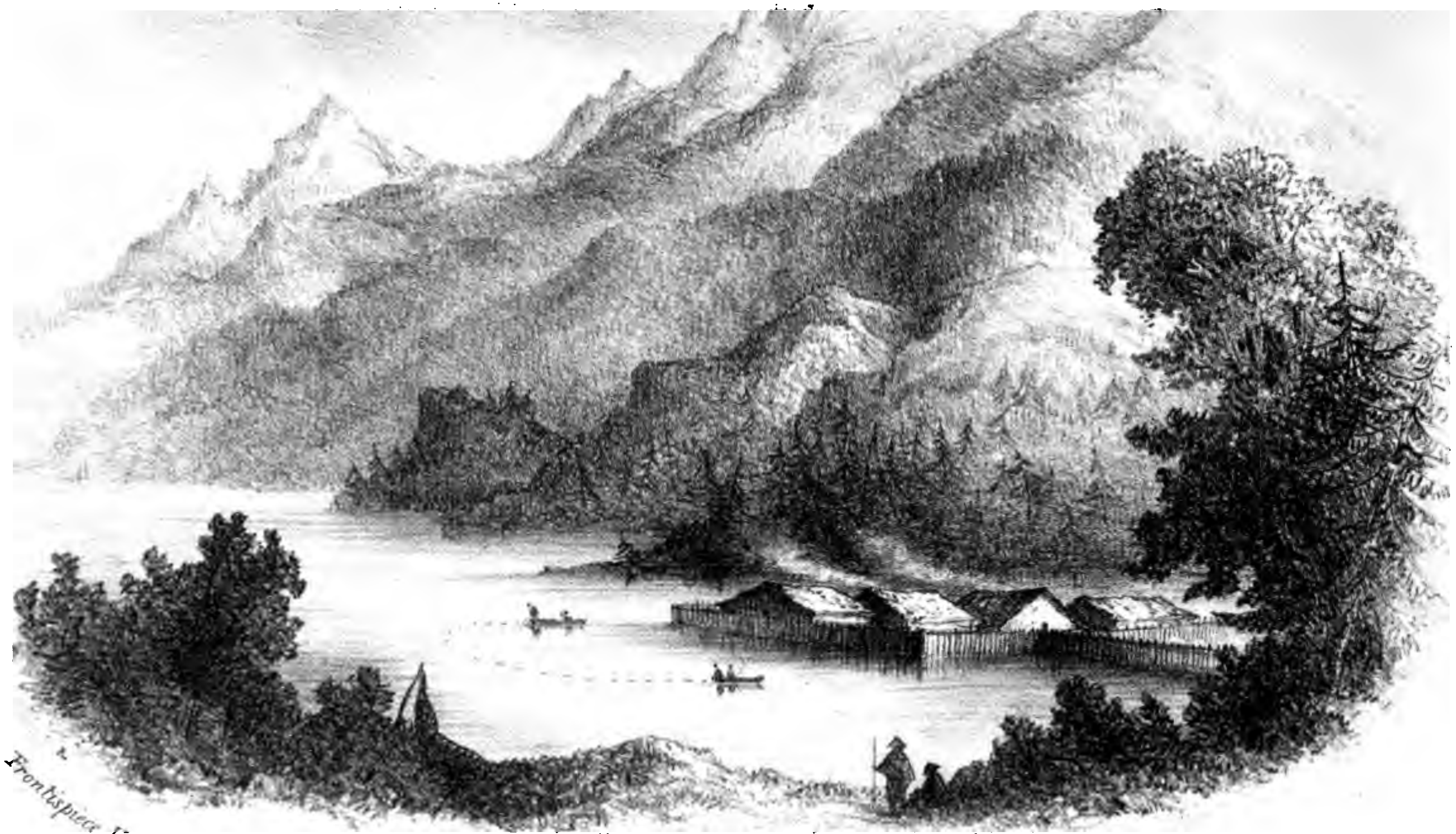
THE

LAKE DWELLINGS OF SWITZERLAND &c.

VOL. I.

LONDON : PRINTED BY
SPOTTISWOODE AND CO., NEW-STREET SQUARE
AND PARLIAMENT STREET



Frontispiece Vol. I.

IDEAL SKETCH OF A SWISS LAKE-DWELLING.

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THE

LAKE DWELLINGS

OF

SWITZERLAND AND OTHER PARTS OF EUROPE

BY

DR FERDINAND KELLER

PRESIDENT OF THE ANTIQUARIAN ASSOCIATION OF ZÜRICH

SECOND EDITION, GREATLY ENLARGED

TRANSLATED AND ARRANGED
BY
JOHN EDWARD LEE, F.S.A. F.G.S.
AUTHOR OF 'ISCA SILURUM' ETC.

IN TWO VOLUMES
VOL. I.

LONDON
LONGMANS, GREEN, AND CO.
1878

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1878

PREFACE

TO

THE SECOND EDITION.

MORE than ten years have now elapsed since the publication of the First Edition. The discoveries made during that period have amply confirmed Dr. Keller's idea that this mode of settlement will be found to have extended very widely. Nearly all the shallow lakes of Switzerland and the adjoining countries are now known to have had pile dwellings on their shores. The large number of facts accumulated in the present edition will at once convince the most sceptical.

In the present edition hardly anything has been omitted which was contained in the first, and the whole of Dr. Keller's seventh report has been incorporated. In addition to this, it has been the endeavour of the Translator to give short accounts of every settlement which has been carefully investigated, so that the work may, he hopes, now be said to contain an epitome, or nearly so, of all that is known of these peculiar structures. It has been no easy matter to collect and arrange such a number of facts, scattered as the notices are in a large variety of publications, and if there should appear to be any want of arrangement or clearness of description, he trusts that he may find an excuse in the large number of objects drawn and described. In the First Edition about fifteen hundred were noticed; the present edition contains the description of between two and three thousand.

Neither time nor trouble have been spared to secure accuracy, but still it is almost certain that some mistakes will be found; the Translator never could have succeeded even in the slightest degree if he had not received almost daily assistance by letter from Dr. Keller.

The restored or ideal picture of a Swiss lake dwelling which forms the frontispiece to Volume I. of the present edition will be found to differ in a slight degree from that of the first, and for the following reasons :—Soon after the publication of the First Edition, Dr. Keller expressed some doubts whether the 'restoration' then given did not make the walls of the huts too high, and my friend Mr. G. H. Kinahan, M.R.I.A., of the Irish Geological Survey, strongly urged upon me that the doors were too high, and that there was no warrant for the windows. If it is not presumptuous to differ in any degree from so accomplished an antiquary as Dr. Keller, I might remark that the objects found in the lake dwellings argue a state of civilisation hardly consonant with living in houses where human beings could not stand upright; and with respect to the windows and doors, I would urge that in several of the lake-dwelling huts it is evident that flint implements were worked by the fireside, and *how* could they be worked in the dark? It seems to me that windows of some kind would be absolutely necessary. Again, with respect to the height of the doors: I know that the Celtic races of the West of Ireland, as Mr. Kinahan has remarked, have very low doors to their huts, and that the inhabitants all but creep into their houses; so do the Samoiedes, and so do the Esquimaux. But is it not probable that the nature and peculiarities of the houses vary with the climate? Low doors would be very useful in the cheerless districts of Northern Asia, the snow-clad wastes of

Greenland, or the rainy wilds of Western Ireland, but they would be wholly unnecessary in the comparatively genial climate of Switzerland. I would by no means wish to be dogmatical, but I must own that my firm belief is that climatic conditions necessarily alter the style of houses. Notwithstanding this, to meet the ideas of my above-named antiquarian friends, the huts in the present frontispiece to Volume I., and of course the doors, have been made somewhat lower, and the windows are much less prominent.

I have only now to return my best thanks to those who have assisted me. I have received great help from several friends as well as from members of my own family, both in drawing and also in the translation of the Italian papers, my knowledge of that language being very limited. Several plates have been kindly drawn for me by my friend Dr. Hounsell of Torquay, and I hope it is not improper to mention that in one or two of the papers, where a knowledge of comparative anatomy was essential, I have received very great assistance from Professor Rolleston, M.D., F.R.S., of Oxford. My friend, Mr. Henry Woodward, F.R.S. (Editor of the 'Geological Magazine'), has aided me with many valuable suggestions, and has given me much assistance in revising the proof-sheets, a task greatly protracted on this occasion by reason of the large additions made to the present volumes. For whereas the First Edition, published in 1866, contained 418 pages of letterpress and 97 plates, the present edition extends to 725 pages, and is illustrated by 206 plates. Once more, if errors should be found in this edition, may I beg for the reader's indulgence on account of the large and varied number of objects which had to be described?

THE TRANSLATOR.

VILLA SYRACUSA, TORQUAY:
January 1, 1878.

PREFACE

TO

THE FIRST EDITION.

WHEN about to visit Switzerland the summer before last, I was naturally desirous of obtaining information as to the antiquities discovered of late years in what have been rightly designated, by a well-known antiquarian friend, as the ' wonderful Pfahlbauten ' (Habitations lacustres), or lake dwellings. Some very excellent notices of them had appeared in English by Mr. Wylie, Sir John Lubbock, Bart. (since then printed with additional information in his late work), and Sir Charles Lyell, Bart.; but still there seemed a want of precise and definite information respecting them.

On arriving in Switzerland, I found that the inhabitants were fully aware of the rich archæological mine, which had been first brought into notice by Dr. Ferdinand Keller, the excellent president of the Antiquarian Association of Zürich. The investigation of the various lake dwellings is now carried on with a zeal and energy, which might be emulated with advantage by our own richer and more numerous societies. Almost all the museums of Switzerland now contain valuable collections of these antiquities: there is hardly a native who is not fully alive to the value of these discoveries.

Under these circumstances, it seemed to me a most extraordinary thing that, notwithstanding the excellent general notices before referred to, so little, comparatively, should be known in England respecting them ; and I therefore, in the autumn of that year, ventured to propose to Dr. Keller, the original discoverer, to make a translation of his reports on this subject to the Antiquarian Association of Zürich, five of which were then published, and the sixth was in progress. To this he most readily and kindly assented ; but he advised that, as the reports had been published at various times, when fresh discoveries were made, the whole should be rearranged and thrown into a more regular form. He also very liberally proposed to send lithographic 'transfers' of the plates for his sixth report (which has been published within the last few weeks) ; and he has also kindly communicated the proof-sheets of it, while in the press ; so that the present work will contain the very latest information which has been obtained on the subject.

Such, then, is the nature of this volume. I will merely add, that it is a simple translation and rearrangement of Dr. Keller's six reports : the order is entirely different ; the language, as far as possible, is his own translated into English. Some few things have, under his direction, been omitted, and several additions have been made by him. In a few instances I have added notes of my own : my province, however, was not to illustrate but to translate ; and, as these few notes rest on my own authority alone, they are marked at foot with the letters *Tr.*

With respect to the plates, it may be well to mention that about one-half are actual 'transfers' (rearranged in the octavo form) from plates drawn at Zürich, either for the last report or for the previous ones. Another considerable portion consists of copies, either by myself or my friends, from the other plates of the Zürich reports ; while a smaller portion, including the sketches of localities, were drawn by myself from nature, or from the objects themselves, during a visit to Switzerland last summer. It was at first intended that each settlement should have one or more plates to itself; and this has been carried out as far as possible: but the number of settlements, and the multitude of specimens (upwards of fifteen hundred in all), and more especially the constant discovery of new objects while the translation was going on, rendered it absolutely impossible to carry out this plan entirely. A full index and a careful description of the plates will, it is hoped, obviate any difficulty arising from this circumstance.

I must be allowed a few words respecting the 'Ideal Restoration of a Lake Dwelling,' which is placed as a frontispiece, as it is not the 'restoration' given in the first Zürich report, which has been so frequently copied; and it might be thought presumption in a translator not to have reproduced the original sketch. But the fact is, since that report was published, a great mass of information has accumulated, which required some change to be made in the restored sketch; and Dr. Keller requested me to design a view in accordance with the latest discoveries. This sketch, therefore, before it was drawn on the stone, was submitted to the author of this volume, and corrected by him in some minor particulars; and after having been transmitted once or twice between Zürich and England, I am happy to say it has now his complete approval.

The foreign weights and measures have all been reduced into those of England, except where they were evidently given merely as approximations, in which case the original numbers have not been altered.

Amongst the multitude of facts which had to be collected from six reports, and placed under their proper heads, some minor mistakes are very probable; but I trust that no great errors will be found. It is not with a view of evading responsibility, but in order to give some authority to the work, that I mention the fact of the proof-sheets having passed rapidly under the eye of the author. I do not mean to say that he has, what is called, 'corrected the press': this was more than could possibly have been expected from him; but even a hasty glance from the author and original discoverer will probably ensure its freedom from great errors.

I have further to add, by Dr. Keller's especial request (and I cannot do this better than in the Preface), that in the following volume it has been his object simply to state *facts*; he leaves almost entirely to others the wide field of speculation. The mass of facts already accumulated is large; it is daily increasing; and it would be premature to speculate where the discoveries of any hour may overturn the theories of the previous one.

Lastly, I do not think it out of place to mention how much I am indebted to my lithographer, Mr. Palmer, of Newport, for the care he has taken as to the plates, especially in the troublesome rearrangement of the 'transfers' from Zürich: some of the copies from the Swiss plates were drawn on stone by Mr. Palmer, junior.

In conclusion, I sincerely hope that the reader may enjoy even a small portion of the pleasure which has fallen to my lot while investigating the subject, and translating this valuable work.

THE TRANSLATOR.

THE PRIORY, CAERLEON:
April 11th, 1866.

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PLATE.

IDEAL RESTORATION OF A SWISS LAKE DWELLING (p. vi of the Preface) *Frontispiece*

LAKE DWELLINGS.

INTRODUCTION.

THE OBJECT of the following pages is to lay before English antiquaries a summary of what has hitherto been discovered respecting the lake dwellings of Switzerland, and the neighbouring countries, together with a glance at the corresponding settlements in other parts of Europe.

These facts were originally published in the reports on the subject laid before the Antiquarian Association of Zürich; but as these communications were made at various times just as the discoveries were unfolded in this new field of enquiry, it necessarily follows that the original reports contain a certain amount of repetition; and also that conjectures made at an early period of the investigation were either confirmed or disproved by subsequent discoveries. The present volume, therefore, is not a simple translation of the reports on the lake dwellings printed by the Antiquarian Association, but a condensed account taken from the whole of them: the substance remains, though the mode of stating it is altered. It may, however, be well to mention that in every case when it was possible, the original has been very closely adhered to, though not the order in which it is given; and in most cases the language and expressions are the same, translated into English. In the present edition the whole of Dr. Keller's seventh report, which appeared in the spring of 1876, has been incorporated; besides which notices of several other lake dwellings, both in Switzerland and elsewhere, by various authors, have been added, so as to bring the information, as far as possible, down to the present day.

It is hardly necessary here to state, what in the year 1855 was new to antiquarians, that from a series of discoveries the fact is made manifest, that in the very earliest times groups of families, or probably whole tribes, subsisting by hunting and fishing, with some knowledge of agriculture, lived on the borders of the Swiss lakes, in huts built not on dry ground, but on a series of piles in the shallows near the shores. Since that time it has been ascertained that this peculiar mode of living was not confined to the inhabitants of Switzerland alone, but extended to several of the neighbouring countries—nay more than this, the information which is rapidly accumulating on all sides will probably bear out the supposition made in the year 1855, that this mode of settlement is to be found in the whole circle of the countries formerly Celtic.[1] At all events, lake dwellings, if not pile dwellings, existed in Ireland and Scotland, and one also in Wales, and these in many respects may be considered analogous to a few of peculiar construction found in Switzerland, although they appear to be very decidedly of much later date. These peculiar lake dwellings will be described in their place.

---

[1] The author in his later reports, has evidently avoided using any names which might positively indicate the nationality of the lake-dwellers.—[Tr.]

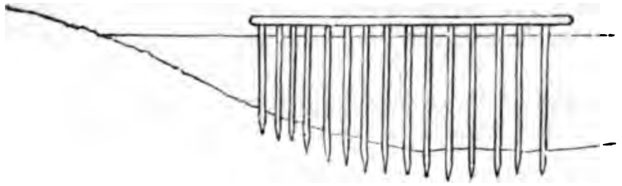
GENERAL FORM.

Before proceeding to a description of the different lake dwellings, and of the objects found in them, it may be well in the first place to give an idea of the general form of these singular settlements, and of the different varieties under which they may be classed. The substructure will naturally claim our first attention.

I. SUBSTRUCTURE.

I. Pile Dwellings.—What may especially be called the pile dwellings are by far the most numerous in the lakes of Switzerland and Upper Italy. The annexed woodcut will give a general notion of the arrangement: piles of various kinds of wood, sometimes split, but in general mere stems with the bark on, sharpened sometimes by fire, sometimes by stone hatchets or celts, and in later times by tools of bronze and probably of iron, were driven into the shallows of the lakes, provided they were not rocky, at various distances from the shore. These piles were placed sometimes close together, sometimes in pairs, sometimes tolerably wide apart—generally in regular order, but occasionally in apparent confusion. In all cases the heads of the piles were brought to a level, and then the platform beams were laid upon them, which in some cases were fastened by wooden pins, in others mortises or central hollows were cut in the heads of the vertical piles to receive the cross beams. Occasionally cross timbers were joined to the upright piles below the platform to support and steady the structure, either forced in, as it were, between them, or fastened to them by what

Fig. 1.



workmen call 'notching,' that is, portions were cut out of the vertical piles to receive the cross timbers. The platform lying on the top of this series of piles appears in many cases to have been of the rudest construction, and to have consisted merely of one or two layers of unbarked stems lying parallel one to another; in a few cases, as in one of the Italian lake dwellings, they were more artificial, and were composed of boards, split out of the trunks of trees, and joined with some approach to accuracy.

In many cases the outer row of piles appears to have been covered or closed in by a kind of wattle or hurdle work, made of small twigs or branches, probably to lessen the splash of the water, or to prevent the piles from being injured by floating wood.

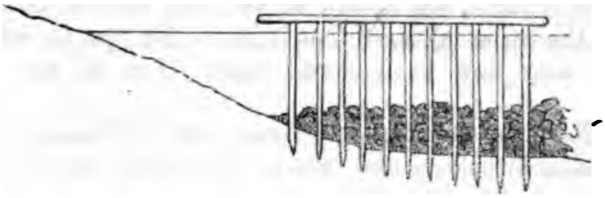
The distance from the shore as before mentioned varied considerably: there appears to have been no regular rule in this respect; it may, however, be well to mention that when a lake dwelling has been inhabited both in the stone and the bronze age, that part evidently used in the bronze age is frequently further from shore and deeper in the lake than that which belongs to the age of stone. With this exception, as far as can be ascertained, nearly the same mode of construction prevailed in the pile dwellings during the ages of stone, bronze, and iron.

Some few of these dwellings appear to have almost touched the shore, but this is not a common case: most of them, as before mentioned, are at some little distance from it, and in all probability they were connected with it by a narrow platform or bridge formed also on piles; in some lake dwellings the remains of these bridge-like entrances have actually been discovered.

In certain cases, as near Nidau, &c., these pile dwellings have another peculiarity: they are formed on artificial elevations at the bottom of the lake, made by a large number of stones, which have evidently been brought in boats, and sunk on the spot for some especial purpose; in fact, one boat or canoe, still loaded with the stones which proved too great a cargo for it, and which consequently sunk it to the bottom, is still to be seen at Peters Island in the lake of Bienne; the particulars will be given when this locality is described. These artificial mounds or hillocks, under the surface of the water, are not uncommon, especially in the western lakes, and all go by the name of Stein-berg. The woodcut (fig. 2) gives some idea of this variety of pile dwelling.

As it seems impossible, according to the opinions of the best engineers, to drive piles into a regular heap of stones, we are obliged to come to the conclusion that the piles must first have been driven more or less deeply into the mud, and that the stones were afterwards thrown down between and around the piles, in order to consolidate the erection.[1]

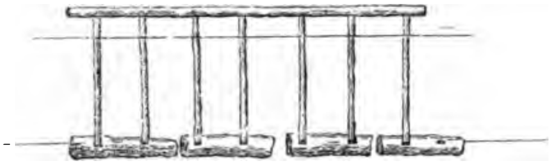
Fig. 2.



- FOOTING

II. **Frame Pile Dwellings.**—The expression frame dwellings, though not very elegant, perhaps explains the peculiar structure better than any other. This form is comparatively rare, and though it has been said to occur in other places, yet we can only actually refer to two or three settlements in the lake of Zürich. The distinction between this form and the regular pile settlement consists in the fact that the piles, instead of having been driven into the mud of the lake, had been fixed by a mortise and tenon arrangement into split trunks, lying horizontally on the bottom of the lake. This plan was chiefly followed where the bottom of the lake consisted of very soft mud, such as would hardly allow of a hold for the piles. In such a case the flat split trunks would be very useful. The above diagram shows the mode in which the plan was applied,

Fig. 3.



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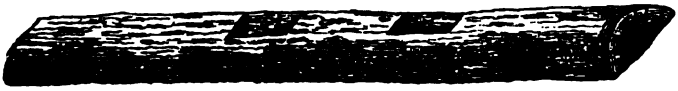
[1] An engineering friend informs me that an arrangement of a similar kind has been used on a much larger scale in the new pier at Portland. Here long piles are driven and screwed down into the tenacious clay, forming the bottom, till they are sufficiently strong to bear a kind of railroad. Huge masses of rock are then brought upon it in trams from Portland Isle, and thrown down between and around the piles, so as to form a regular breakwater against the heavy seas which beat on that coast. I am also informed by the engineer of the harbour of refuge at Holyhead, that precisely the same plan is adopted there with their long piles, except that they are not screwed but driven in to support the stage from which the stone is thrown.—[Tr.]

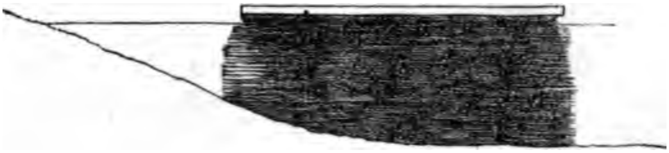
and the annexed woodcut is a sketch of one of the actual beams brought up from the bottom. Several of these stems, with holes in them, are known to be lying on the bottom of many of the Swiss lakes, so that it is *possible* that this form of structure may have been more common than we at present imagine.

FIG. 4.



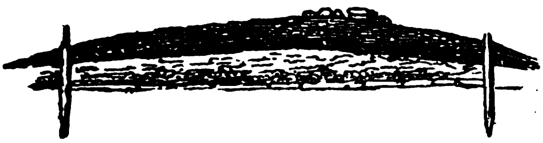
III. FASCINE DWELLINGS.—Some lake dwellings were of very peculiar structure, and may be designated fascine dwellings. Instead of a platform, supported on a series of piles, these erections consisted of layers of sticks, or small stems of trees built up from the bottom of the lake, till the structure reached above the water mark; and on this series of layers the main platform for the huts was placed. Numerous upright piles are indeed found in dwellings of this description, but they were not used to support the platform as in the pile dwellings just mentioned, but chiefly as stays or guides for the great mass of sticks, in successive layers, which reached down to the bottom of the lake. The woodcut annexed shows a section of a lake dwelling built on this peculiar plan. As several settlements of this kind will be carefully described in the course of the following pages, it will be unnecessary at present to enter into further detail. It may, however, be well to mention that fascine dwellings occur chiefly in the smaller lakes, and apparently belong to the stone age.

FIG. 5.



IV. CRANNOGES, or 'WOODEN ISLANDS.'—These singular structures bear a great resemblance to the class last described, although, doubtless, of much later date. They are found chiefly in Ireland and Scotland, but one has been discovered in South Wales. They were first brought into notice by Sir W. R. Wilde, in the Proceedings of the Royal Irish Academy for 1840, and several were subsequently described by Mr. Shirley and other investigators. Sir W. R. Wilde's 'Catalogue' contains notices of several crannoges. They have also been found in some of the Scotch lakes, especially in Dowalton Loch, which was drained by Sir Wm. Maxwell of Monreith. Several crannoges then discovered have been described by Lord Lovaine and Mr. John Stuart. As it is intended in the course of the following pages to give a notice of the structures of this kind found in Great Britain and Ireland, it will be sufficient at present merely to state that the crannoges at least in Ireland were frequently but not exclusively placed on natural islands, or on shallows which approached to this character; sometimes they were built up from the bottom of the lake on the soft mud, exactly in the manner of the fascine dwellings of Switzerland. They are surrounded by a stockade of piles, driven into the bed of the lake, so as to enclose either a circle or an oval; the diameter varies from 60 to 130 feet. These piles are usually in a single row, but sometimes the rows are double and even treble. Occasionally the piles are boards, not round stems. The lowest bed within this enclosure is commonly a mass of ferns, branches, and other vegetable matter, generally covered over with a layer of round logs, cut into lengths of from four to six feet, over which is usually found a quantity of clay, gravel, and stones. It will be seen from this short statement that these Irish crannoges have a great analogy with the fascine dwellings of Switzerland, and this will probably appear still more clearly when the details are given hereafter. This similarity is very striking, when we consider that the Swiss dwellings were evidently places of permanent habitation—that families and perhaps tribes lived on them; while the Scotch crannoges as mentioned by Mr. Stuart are chiefly to be regarded as chieftains' forts, and fastnesses for occasional retreat. Unlike the fascine dwellings of Switzerland, which belong chiefly, if not exclusively, to the age of stone, the crannoges, whatever may be the age of their foundation, continued down to the age of iron—nay, they were actually used at a very late period; whereas the lake dwellings of Switzerland, as far as we at present know, disappeared about the first century. The above woodcut will

Fig. 6.



probably give some idea of the appearance of these crannoges; but it is difficult to represent a structure of this kind merely in section, which necessarily is the case with the vignette, and the reader, therefore, is referred for more particulars to the detailed description.

II. SUPERSTRUCTURE.

Under this head there is naturally very little to say: in fact, a few words will suffice for all that we have to communicate. Except under very peculiar circumstances, timber and vegetable matter cannot possibly exist long when exposed to the summer's sun and the winter's storms. Still there are indications, though slight ones, as to the construction of the huts, and these will now be stated as briefly as possible.

It has been already mentioned that the main platform consisted either of round timber, or (in some few cases) of split boards. Upon this it appears that a bed of mud, loam, and gravel was laid, and beaten down firmly, either by the feet, or by the wooden mallets of which several have been found in these localities. Occasionally, a layer of larger pebbles is found, as in some of the Italian dwellings, near the top, probably to strengthen this kind of plaster floor.

There can be no doubt that small piles or stakes formed the framework of the huts. Some of these have been actually found projecting considerably above the platform. Probably, in some cases, especially in the fascine erections, fresh piles were driven in for this purpose, which did not go quite down to the bottom of the lake; but in the regular pile buildings, they would only be piles of an extra length.

Of course these piles would mark out the extent of the dwellings themselves, and in one or two favourable instances we have thus the ground plan of a settlement; but we have more than this: the size of the house is further marked out by boards, forced in firmly between the piles, and resting edgeways on the platform, thus forming what at the present day we should call the skirting boards of the huts or rooms. It cannot now be determined whether this was continued higher than a single board, as more than this has not as yet been actually discovered; but the advantage of even a single plank, set on edge, to keep out wet, and wind, and vermin, must be generally evident. It is also perfectly certain that the walls or sides were in a great measure made of a wattle or hurdle-work of small branches, woven in between the upright piles, and covered with a considerable thickness of loam or clay; this is proved by numbers of pieces of clay half burnt, or hardened in the fire, with the impressions of the wattle-work still remaining. These singularly illustrative specimens are found in nearly every settlement which has been destroyed by fire.

All the evidence which has yet come before us proves that the huts were rectangular; but some of them may possibly have been round, as, from ancient authors, it is very evident that the huts of many nations on terra firma were round in form.

It is not known whether the huts were divided into several rooms or not; possibly further discoveries may decide this. From the remains of straw and reeds found in every lake dwelling, it seems almost certain that the huts were thatched with these materials, and highly probable that the dormitories were strewed with the softer kinds of straw or hay.

Every hut had its hearth, consisting of three or four large slabs of stone; and it is probable from the almost universal prevalence of clay weights for weaving, that most, if not all, of them were furnished with a loom. Portions of young trees with the branches partially lopped off are also not uncommon in these dwellings; these would be very convenient, if fastened to the roof or the walls, for the suspension of the mats, the tools, the nets, or the earthenware vessels, some of which seem to have been used with rope handles.

Such is the whole which we actually know, or have a reasonable probability for believing, as to the huts themselves; and beyond this it is not the province of the sober antiquary to enquire.

METHODS EMPLOYED IN COLLECTING THE LAKE-DWELLING ANTIQUITIES.[1]

Probably this may be a suitable place for mentioning the mode in which lake-dwelling antiquities are collected. Some lakes have of late years been either wholly or partially drained, especially those where peat has grown. In these cases the level of the water having altered, the search for antiquities has to be carried on by actual excavation either in the peat or in the ancient bed of the lake. In some cases, however, as at Robenhausen, the peat can only be excavated to the proper depth by keeping pumps almost constantly at work.

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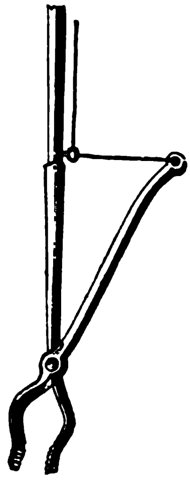
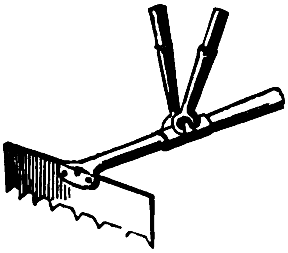
[1] This notice has not appeared in any of the original reports to the Zürich Association, but it seems so essential that English antiquaries should know the methods employed by their Swiss friends, that it has been inserted in the text together with the illustrative woodcuts.—[Tr.]

Fig. 7.



Under ordinary circumstances, however, the case is different, and the antiquities have to be looked for in the lake itself, occasionally at considerable depths, either lying on the surface of the lake-bed, or buried to some extent in the mud. In localities where the former case occurs, and where, strange to say, these primæval antiquities appear still on the surface of the lake bottom after having been exposed for thousands of years to the gaze of every boatman who passed over them, all that is required is a keen eye, clear still water, and a pair of forceps similar to those represented in the annexed woodcut. This simple instrument is fixed to the end of a long pole, and as will be seen from the sketch opens and shuts by means of a cord.

Fig. 8.



But, where the antiquities are buried in the mud, the labour is much greater; in this case a kind of implement similar to that shown in the annexed woodcut, is used for trenching the bottom. The scraper itself is fixed to a strong pole, and is pressed down into the mud by means of two wooden handles attached to it by sockets and rings; these handles are worked from the boat above. This arrangement makes the scraper more effective, so that trenches can be dug, or rather scraped, of a considerable depth, and a large quantity of mud can be collected together, which is then brought up by the usual implements and examined. It is obvious that this operation must be very difficult where the ground is encumbered by stumps of piles or stones; and it is but due to the Swiss antiquaries to mention the difficulties with which they have to contend in pursuing their investigations.

Where railway or other works are in progress a steam mud-engine sometimes brings to the view of the antiquary a great quantity of mud from the bed of the lake; but the advantage thus gained is almost negatived by the fractured condition in which many of the antiquities are brought up.

ORIGINAL DISCOVERY OF THE LAKE DWELLINGS.

Though the settlement or lake dwelling of Ober Meilen will hereafter be fully described, yet it may be well here to give a short account of its original discovery, as it was the first of these singular localities which was at all carefully examined, and of which the antiquities were preserved; and from its discovery we may date the long series of investigations which have yielded such a happy result to the labours of the antiquary.

It appears that so early as the year 1829 an excavation was made on the shore, in front of this place, for the sake of deepening the harbour, and piles and other antiquities were discovered. Unfortunately these facts do not seem at the time to have come to the knowledge of any antiquary; at all events, the matter was not then followed up, and we possess no precise information respecting this excavation; the earth dug out was put into boats with all that it contained, and then taken away and sunk in the deepest parts of the lake. Thus the matter rested for some years.

In the winter of the years 1853 and 1854 the extraordinary drought and long-continued cold occasioned a very unusual phenomenon in the Alpine districts—the rivers shrank to their smallest compass, and the level of the lakes was lower than had ever been known before. On the stone of Stäfa the water mark of 1674 had always been considered the lowest known in history, but in 1853-4 the water was one foot below this mark. The low shelving shores became dry land, and islands appeared never before noticed. These circumstances, though unfavourable for millers and watermen, were very advantageous for the erection of buildings by the water's side; and they were especially welcome to the archæologist, as many interesting localities were thus brought to light, which for centuries had been withdrawn from view, and doubtless will not for a length of time be accessible to future generations. While remains of Roman construction came to light on the banks of the Rhine, the Aar, and the Limmat, antiquaries were able for the first time carefully to examine the settlement of hoary antiquity above mentioned in the lake of Zürich.

In January 1854, Mr. Aeppli of Ober Meilen informed the society at Zürich, that remains of human industry, likely to throw unexpected light on the primæval history of the inhabitants of the country, had been found near his house in that part of the bed of the lake then left dry by the water.

The discovery of these antiquities was made in the following manner:—The inhabitants were making use of the low state of the water to recover from the lake a certain portion of land, which they had enclosed with walls, and were filling in the space with mud, excavated from the shore a little in front. This was done at two places in the little bay between Ober Meilen and Dollikon. The workmen, as soon as they began to excavate, found to their great astonishment the heads of piles, and a great number of stag's horns, together with several implements, an account of which will be given in the detailed description of this settlement. It will be sufficient at present merely to refer to the plan drawn (Plate I., fig. 1), made by Mr. Aeppli, which shows the localities of the different excavations. As this was the first lake dwelling which came to light, it seems desirable, before entering on the general subject, to give the particulars of a discovery which was so quickly followed by others, and has led to results of such extraordinary interest.

In this plan, A shows the place where an excavation took place in 1829, and piles and antiquities were discovered. B the land recovered by Mr. Glogg in 1851, when piles and implements also were found. C the embankment of Mr. Grob in 1854, and DD the places which supplied the material for filling in. E the embankment of Mr. Rhyner also in 1854, and FF the places from which the mud was dug out. The extent of the piles and consequently of the settlement is marked by the space covered with upright dotted lines.

REMARKS ON THE AGES OF STONE, BRONZE, AND IRON.

It is well known that many antiquaries divide bygone ages into the stone, the bronze, and the iron periods; and attribute any burials or settlements to one of these divisions, according to the exclusive or prevailing presence of implements of any one of the three materials which are the groundwork of this classification. This division, according to the grade of civilisation, is, in general, clear and convenient; but in determining isolated cases it leads to many false conclusions and errors. In the first place, it has throughout only a relative value: for instance, if we grant that the civilisation of man actually ran its course through these periods just as they are mentioned above, yet it is certain that the bronze period of northern Europe by no means agrees in time with that of the middle and southern parts of this continent. Again, the bronze age of Greece and Italy may be separated by centuries from that of Egypt, which we may consider as the cradle of civilisation. We may safely conclude, as the Danish antiquaries themselves allow, that in the Scandinavian countries, stone implements were for a length of time continued in use while the bronze period was in full activity in the more southern lands, and that Egypt, whose oldest monuments indicate very clearly the use of iron, and also Greece, had both advanced to the iron period when middle Europe was in the bronze age. If, therefore, according to the testimony of ancient authors and monuments, bronze and iron were used in the earliest ages in the countries round the Mediterranean, the commencement of these periods in the inland and northern parts of Europe was regulated entirely by the greater or less amount of intercourse between these countries, and those to whom we are indebted for a knowledge of these materials, so essential to civilisation. We may even at the present day observe a similar irregularity in the distribution of the products of higher civilisation and art. In the second place, this kind of division gives us no positive certainty; for in very few of the burial-places, still less in the regular settlements, are the remains found so purely distinctive as to enable us conclusively to attribute them to any one of the three periods. The materials on which this division is based are mixed to such a degree, that in nine cases out of ten the antiquary remains undecided as to what period of civilisation he should assign a grave or a settlement. An object very commonly both in form and material bears the character of different periods; or it may be a specimen useless in deciding the age, being found in settlements of all the three periods. Thus the stone celt is an unsafe guide in determining the period of civilisation, though it strictly represents the stone period, because it occurs in all stages of the bronze age, and is not unfrequently found associated with iron weapons and instruments.[1]

It is very certain that, at least in Switzerland, there was no hard line of demarcation between the three periods, but that the new materials were spread abroad like any other article of trade, and that the more useful tools gradually superseded those of less value.

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[1] Kirchner has given many cases of this kind, 'Thor's Donnerkeil,' p. 25.

Though it has been thought necessary to give these words of caution as to the use of the three periods in a very definite and rigid manner, yet, rightly understood, the division is very convenient, and it will be adopted to a certain extent in the following detailed accounts of the various lake dwellings hitherto discovered. Of some of the settlements we know a great deal, of others but little, and of very many we have only indications. Probably the best plan will be, first to describe the settlements most known, or most typical of the stone, the bronze, and the iron ages; and then it may be advisable to give a geographical list of the whole of the lake dwellings hitherto discovered, including those of which all that we know is their existence.

MEILEN.

This well-known locality, the first discovered of all the lake dwellings, has been in some measure described in the chapter giving the original discovery of these singular structures; at present, therefore, it only remains to complete the description of the place, and to give an account of the objects which have been found there. It is a settlement of peculiar interest, not merely because it was the one first known, but also because it belongs almost exclusively to the stone age. The only objects of metal which have come to light are a single bronze armilla (Plate III. fig. 12), found in the course of the early embankment, and one bronze celt, discovered in a late excavation by Colonel Schwab of Bienne (Plate III. fig. 26). With these two exceptions, all the antiquities consist of stone, bone, horn, wood, or baked clay.

According to Professor Linth Escher, the following is the geognostic sequence of the beds:—'In the places excavated, the upper bed, from one to two feet thick, consisted of yellowish mud, such as we see everywhere accumulated in the shallow indentations of the lake when not much exposed to the action of the waves. The numerous rounded pebbles found in it had doubtless been brought down during floods by a small brook which empties itself into the lake. In this bed the workmen observed no traces either of piles or of animal remains.

'The second bed, from 2 feet to 2½ feet thick, consisted also of sandy loam, but from the decay of a great quantity of organic matter in it, it was coloured black. It was in this bed, which for the sake of convenience we will call the "Relic-bed" (Cultur-schicht),[1] that the heads of piles were found, as well as the antiquities which are about to be described. (See Plate I. fig. 2.)

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[1] It is somewhat difficult to translate this word 'Cultur-schicht.' The nearest English words for 'Cultur' are Civilisation, and Culture; but in neither case is the full meaning of the German word expressed. Culture in English, even in a figurative sense, can hardly be said to apply to matters of handicraft, being used chiefly with reference to the mind; Civilisation, again, seems to apply chiefly to the manners. The

'The third bed, which probably is of considerable depth, consisted, like the first, of undisturbed mud or loam, such as that found everywhere at the bottom of the lake. It contained the lower part of the piles, but no traces of human art or of animal remains.'

The question how far the relic-bed, or in other words the settlement, extended cannot be answered with certainty. The inhabitants of Ober Meilen assure us that no piles are to be found in the immediate neighbourhood of the bank. The rows of piles begin several fathoms from the shore, and continue till the lake suddenly becomes deep. The limit of the piles on either side is uncertain, but it is probable that they do not reach far beyond the extreme point of the bay. It is a singular fact that the remains of human art are much more numerous on the side next the lake, so that the chief places of abode must have been situated not on that side of the piled space nearest to the land, but towards the opposite margin.

The piles consist of oak, beech, birch, and fir, and are from four to six inches thick. Some few of them are whole trunks, but these may be considered as exceptions; the majority, as may be plainly seen from the rings of growth, consist of stems, split into three or four parts. All the piles discovered in the first excavation were more or less charred, and had been sharpened at the lower end either by means of fire, or by the stone celt; it was plain that fire had been used for that purpose to save the great labour caused by such inefficient tools. It is singular that somewhat different results were brought to light by the excavation made by Colonel Schwab, which shall now be mentioned.

The low level of the water in February 1858, induced this gentleman to make a fresh investigation of the place, especially as that of 1855 was by no means undertaken with a view to archæology. Under his direction the ground was excavated on the strand, then laid dry, first between the letters FF (see the Plan, Plate I. fig. 1), and then, after the erection of a cofferdam, to the right of the letters DD. The objects found consisted of stone, bone, and horn implements, similar to those previously

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German word 'Cultur' seems to refer to mind, manners, and art of every kind, including handicraft skill. Besides this, the term 'Civilisation bed' is one which could not be used, and 'Culture bed' sounds nearly equally harsh. Some French writers translate the word 'Couche Archéologique,' which does not seem quite satisfactory. I had at first translated it 'Implement bed' though with some misgivings; but when a well-known antiquarian friend, the Rev. C. W. King, suggested the term 'Relic bed,' all difficulty vanished: it is not a literal translation, but it seems to come as near as possible to the implied meaning of the German word.—[TR.]

found. Amongst rather a large number of stone celts there are several of clear nephrite, which appears to be found more plentifully here than elsewhere; and, what is very singular, one well-preserved bronze celt as before mentioned (Plate III. fig. 26), thus showing that the existence of this settlement had reached the bronze age. Besides this, there was another singular fact: near the second of the places above mentioned, where the piles had been sharpened by fire, others were found which had been brought to a point by a sharply-ground bronze celt or hatchet, thus proving, as it were, the genuineness of the bronze celt. Bones were found in great numbers, amongst them those of the stag, roe, wild goat, wild boar, and fox, besides those of domestic animals, such as the cow, the sheep, and the dog. Some human remains were also found here.

The original length of the piles cannot now be determined, as they only reach up into the relic-bed, and the actual summits, which were doubtless above the water level, have long since disappeared; they must, however, have varied very much in length, for some, which were completely dug out, measured seven or eight feet, while the ends of others were not reached by digging nine or ten feet under the relic-bed. Nearly all of them were so soft and rotten that they were no hindrance to the workmen's spades, and were as easily cut through as the silt itself. It was almost impossible in the hollows filled with mud, where the labourers had to work, to mark out the arrangement of the piles, and to measure with any accuracy the distance between them; but according to the report of all the workmen, the rows of piles run parallel with the shore, and in tolerably straight lines, forming also other lines nearly straight at right angles. In some places they stand closer together than in others, but on the average they are about a foot or a foot and a half apart. Their arrangement is shown in Plate I. fig. 3. Between the vertical piles a few beams were met with, lying horizontally, stuck in the mud, and which apparently had been part of the scaffolding or platform resting on the piles. As we shall hereafter have to treat of the use of these piles, we will now proceed to the description of the objects found here.

OBJECTS IN STONE.

Stone Celts and Stone Chisels.—These tools, which are the most abundant of all early stone implements, and are spread over France, Germany, England, Scandinavia,[1] and doubtless every European[2] country, form the most important portion of the antiquities discovered at Meilen. They are remarkable, not merely for their number, but for their variety, both in form and material. As no notice was taken of them till after Mr. Aeppli's suggestion, and the workmen say that a very large proportion were either not preserved at all, or were afterwards thrown aside as useless, it may easily be imagined that several hundred specimens were buried in the few square fathoms of ground excavated. About a hundred of these implements, some in good preservation, others somewhat damaged, have come into the hands of the Zürich Antiquarian Association.

The usual form of these implements, or stone celts, as they are called, is that of a wedge. If the cutting edge spreads out or is broader, they resemble hatchets; but if they are of uniform breadth or bulge in the middle, not an uncommon case, then they take the form of chisels. The section of many specimens about the middle is square with sharp corners; others are roundish or oval in section, and consequently approach the form of a cylinder. There are examples where one side of the cutting edge is concave and the other convex, so as to have the appearance of gouges, and very probably they have been used as such. In many specimens, the sloping sides show the natural roughness of the stone, while others have them ground or smoothed; but a great number, after having been polished on these parts, have again been intentionally made rough or grained.

In size these instruments vary exceedingly, so much so that while some are eight inches long, the smallest is only one inch in length, and while the weight of the largest is a pound and a half, that of the smallest, of the same kind of stone, is only about a quarter of an ounce. (See Plate II. figs. 12 and 13 where the figures are drawn of the actual size.)

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[1] Stone implements have been found of all shapes in Denmark; they are described in 'The Primæval Antiquities of Denmark, by Worsaae, translated by William Thoms.' London, 1849. And in the 'Nordisk Tidsskrift for Oldkyndighed udgivet af det kongelige nordiske Oldskrift-Selskab. Forste Binds andet Häfte.' Copenhagen, 1833.

[2] It is mentioned by the Livingstones in their 'Narrative of an Expedition to the Zambesi,' as a remarkable fact, that while in many parts of the world the stone, bronze, and iron instruments of men who have passed away have been found, no flint arrow-heads, spears, axes, or other implements of this kind, so far as we can ascertain, have ever been discovered in Africa. This statement must be taken to apply only to those parts of this continent which had been visited by Dr. Livingstone, for both at the Cape of Good Hope, and also in some parts of the northern coasts of Africa, it is well known that stone implements are not uncommon.—[Tr.]

With respect to the material, these implements consist partly of native, and partly of foreign stone, at least of such kinds as have not yet been found *in situ* in Switzerland; and in some cases even of stone the existence of which in any part of Europe has not as yet been ascertained.

Many celts consist of diallage, gabbro, and hornblende rocks. none of which are found in the gravel of our neighbourhood, nor have they, generally speaking, as far as is known, been discovered in the Alpine districts. The material is not very accurately designated by these names, for, in fact, it is a variety between the rocks just named and the talco-silicates.

Other specimens consist of syenite, like that which is found *in situ* in the valley of the 'Vorder-Rhein,' and is also frequently found in the gravel of the valleys of the Rhine, the Limmat, and the Glatt. In one single case the stone is very like the fine-grained black sandstone of the Nummulitic formation of the high Alps of Glarus, such as is seen at the Hausstock and the Panixer Pass. Those made out of nephrite or jade probably derive their origin not from Europe, but from the East. We may have more to say on this point hereafter.[1]

Several specimens show incisions and other marks of working which reveal to us the mode in which the celts were manufactured. Stone of a tough nature was chosen for this purpose, and then incisions were made in the flat surface by means of a sharp saw-like tool, sometimes on one side and sometimes on both;[2] the stone was then broken in two, just as slabs of slate are brought to the proper form for writing and roofing slates.

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[1] Montfaucon Antiq., exp. vol. v. p. ii. p. 194.—In the year 1685, an axe made of eastern stone called jade, a kind of lapis nephriticus, was found by M. Cockerell in a tumulus in the diocese of Evereux (Normandy).

Celts made of a kind of nephrite are to be seen in the Royal Museum of Antiquities in the Castle of Monbijou at Berlin, and also in many of the museums of Germany, France, and England.

In vol. lxi. of the Tr. of the Imp. Inst. of France, M. Damour has published an interesting paper on the so-called nephrites in the Celtic tumuli: he does not consider the stone to be true nephrite. He thinks that several of the celts from Meilen are diorite. (See the volume on 'Nephrit und Jadeit,' published by Professor Fischer of Freiburg, which apparently nearly exhausts the subject.)—[Tr.]

[2] In the 'Anzeiger' for March, 1870, No. 36, p. 122, there is a curious paper by Dr. Keller on the probable mode of making these incisions; it is illustrated by the sketch of a thin branch of a tree at right angles with the trunk and bent down at the end by a weight. Between the weight and the stem of the tree there is a pole with a

Other specimens made of stone which was not at all slaty, were first hammered into form, and then ground, a work which must have been attended with much labour. All the celts seem at first to have had a very sharp cutting edge; we have several specimens which might readily be used for cutting lead pencils.

With respect to the place where these stone celts and chisels were manufactured, there can be no doubt at least with reference to a considerable number of them, for several specimens were found at Meilen, which had been partially worked, but were not completed; that is, they were in process of manufacture. Besides this a number of fragments were found, which are easily recognised as the refuse from chipping or sawing the material into form. Lastly, we have a number of stone slabs which have served for grinding these implements. The slabs are of sandstone from the quarries of Bollingen, on the upper part of the lake of Zürich, which have been much used from the time of the Romans. Deep furrows and grooves are found upon them, caused by the backwards and forwards motion of the celt, which had to be ground or sharpened upon them. Other slabs of somewhat harder stone, but brought from the same place, had a surface as smooth as a looking-glass—a proof that they were used for polishing off the celts. From all this we may with safety conclude, that the celts of native stone were made and completed by the manual dexterity of the inhabitants of the lake dwellings of Meilen; but it must be left undecided whether the celts of foreign material were brought here already made, or in the shape of raw material.

The mode of hafting these tools is very interesting. All the celts and chisels found at Meilen originally were hafted in pieces of stag's horn, and a considerable number were found still in their handles. To make this hafting, a piece of the requisite length and thickness was cut out of the main stock of the stag's horn, clearly with no other instrument than a stone celt. A hole was then worked out at one end, wide and deep enough to receive the small end of the celt. The other end was cut into a four-sided tenon or plug, evidently intended to be set in a shaft, a stick, or a club. (Plate II. fig. 2.) Of this third limb

fork at the top, between the prongs of which runs the weighted branch, while a flint saw or tool is made firm in the lower end which is split. If this flint tool rested on the stone to be cut, and the upright branch were moved by hand right and left, a regular, well formed incision would soon be made in almost any kind of stone. It may be well to add that the lines within most of the cuts are just such as would be made by this arrangement, that is, they are not straight, but exhibit segments of a very large circle, the upright forked pole being the radius.

of the implement not a single perfect specimen was found here, for every thing of wood which was not sunk like the piles in the mud, had lost all consistency, and although the fear of the thaw setting in prevented any investigations which took up time, yet some slight remains of wooden shafts of this kind give us a clear insight into their general form. The perfect implement complete with all its three parts, has been found at Robenhausen. (Plate X. fig. 7.)[1] It appears to me, however, that the plan of inserting stone celts first in a piece of stag's horn and then in a wooden club is by no means a workmanlike arrangement, although this mode of using the celts became almost universal; for haftings of this kind are found in all the lake dwellings of Switzerland, more especially in those of the western lakes. They occur both perfect and broken by thousands, so that we may reasonably conclude that in those ages the stag was very plentiful in our forests. I cannot say when and where this plan of hafting was discovered; but thus far is certain, that haftings of this kind are found in all the settlements of the stone and bronze age in Switzerland, Savoy, Upper Italy, and Austria.

It is probable that, in the earlier ages, the stone celts were set directly in wood, and that the intermediate hafting of stag's horn afterwards came into use. But the tool thus made of the three portions very soon became general, notwithstanding the immense time and labour which would be required in the manufacture.

The plan of proceeding has been described above, but one can hardly imagine the labour and skill which would be required to make the celts fit in the pieces of stag's horn cut from the antler. The inside of the horn, indeed, is porous, and when the horn is fresh it is soft, but in all these haftings this inner portion has been entirely removed, leaving only the solid exterior part. If these haftings are examined we shall easily be convinced that the holes must have been chiselled out at a great expenditure of time, so that the celts might exactly fit.

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[1] Pieces of stag's horn with stone celts fixed in them, such as those drawn (Plate II. fig. 4), but bored through in the middle so as to receive a handle, are to be seen in the museum of Amiens. In the year 1842, a stone celt fastened in this manner was found in a grave near the little town of Crécy not far from Meaux, 'Investigateur,' 1854, Janvier. 'On y a recueilli des coins en silex et en serpentine, des amulettes en serpentine et une espèce de poinçon très-effilé, formé d'un morceau de tibia de chèvre ou de chevreuil, mais on y a trouvé un objet qui offrait un caractère particulier d'intérêt; c'est une hache formée d'un beau coin en jade, parfaitement aiguisé, ajusté dans un gros morceau de corne de cerf, dans lequel est pratiquée une mortaise destinée à recevoir un manche.'

If the hole were too small the hafting would split at the first blow, and if it were too large it would shake and fall out. The first-named fault, that of breaking or cracking, might be met by binding the tool round with cord. Moreover, it must be borne in mind that after a certain time, when the stag's horn had become dry, all the haftings would crack and would be useless. This may account for the number of cracked haftings which have been found. The second fault might be remedied by putting asphalt round the celt, or by caulking the hole with birch bark, or with leaves or grass.

The tools used for cutting the holes were chiefly small chisels, or sometimes the teeth of animals set in stag's horn.

But the labour of fixing the intermediate hafting in the wooden club was much easier than that of fixing the celt into the hafting, for if the club were put into water the wood would swell and hold the hafting fast. Besides this, the settlers had found out another means of holding the hafting perfectly fast in the club, for in some instances the club and the hafting inserted in it were perforated, and a pin or bolt fixed in the hole, thus securely fastening both together.[1]

Another form somewhat different from that last described is given. (Plate II. fig. 4.) Stones were frequently found put into longer pieces of horn so as evidently to be used as chisels. In one long piece of horn, each end had a chisel of nephrite fixed in it. (Plate II. fig. 3.)

With respect to the use which was made of these stone celts or hatchets, there has been a great discussion for more than a century, both as to them and to their allied forms in bronze. Some antiquaries consider them as weapons of war, others as household implements, others again as instruments of sacrifice, and some as symbols. The stone celts found at Meilen appear to throw considerable light on this very debatable question. In the first place, we must express a decided opinion against the idea which has lately reappeared that these stone celts were used for religious purposes alone, and that they were not employed either in the house or workshop.[2] For, amongst the celts found at Meilen, by far the greater number are more or less damaged by notches and fractures on the cutting edges. Many specimens had been cracked, either lengthwise or across, and had been thrown aside as useless; and even in many perfect celts, it may be seen that the edges which had been spoiled had been repaired and ground: in fact, some had evidently been quite worn away by repeated grinding. The value which was especially set upon celts made of nephrite is shown by the fact, that when a part of the edge was cracked off, the rest of the celt, even when the edge was only a few lines broad, was again carefully ground; nay, even hatchets which had the whole cutting edge broken were reversed, and an edge made at the opposite end—so carefully was every fragment of a good stone brought into use.

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[1] Communicated by letter from Dr. Keller.

[2] Kirchner, Thor's Donnerkeil, Neu-Strelitz, 1853.

It has been already remarked, that in the first excavation all the piles found were made sharp, to lessen the labour of driving them in, either by means of fire, or by the stone celt or axe. Five of the piles in the best state of preservation, consisting of fir wood, were examined by carpenters and joiners, and their unanimous opinion was, that from the nature of the strokes the hewing, or rather the hacking, of the points indicated very clearly the use of the stone hatchet, and that no tool of any kind of metal, nor any usual instrument of carpentry, had been employed about the work. In order to test the possibility of working timber with such tools, and to prevent any doubt which might arise, we had several trials made with these stone implements, and they have perfectly convinced us of the correctness of the conclusions arrived at. It must, however, be remarked, that the trials were made with green wood, and that very probably the builders of these lake dwellings did not use dry timber, but fresh wood, just as it was brought from the forest. If we also examine the handles and other implements of stags' horns with the view of ascertaining how they were worked, we shall come to the conclusion, notwithstanding the fact of one or two bronze implements having been found here, that with the exception of the few piles found in Colonel Schwab's second excavation, not a single specimen shows the work of any metal tool, but that they have been brought into their present form by stone implements alone. The horns had evidently been worked when fresh, or after having been softened by steeping in water.

The choice of the kind of stone was made according to the practical use for which the tools were intended: thus, every material worked into celts possessed in the highest degree the qualities of toughness and strength. A harder, but more brittle, substance, even if very conspicuous by its colour, was disregarded, at least, in our district, where so many different kinds of stone are to be met with. No celts, consequently, are to be found in our museums made of granite or any kind of limestone.

With respect to the use made in general of these stone celts, we can hardly be wrong in concluding that they answered the most varied requirements according to their size and form, the nature of the material, and the mode in which they were hafted. It is possible that the stone celt fixed in the end of a pole may have served as a lance point;[1] if set in a club, either with or without a horn hafting, it would be equally useful as a weapon of war, or an axe for household purposes. Either fastened in a longer piece of horn, or without any handle at all, it stood in the place of the poor man's knife for all kinds of handicraft work, and formed the chief implement of the household, which as yet was but scantily furnished with tools. It doubtless, in short, fulfilled all the requirements which antiquaries attribute to it, and served for skinning animals, for cutting the flesh in pieces, for cutting and manufacturing the hides, for preparing clothes, and all the different implements whether of horn or wood. In short, it was probably applied to many more purposes than we can imagine, unacquainted as we are with the habits of life of those who used it.

It may not be amiss here to mention, that the inhabitants of New Zealand, who thoroughly understood working nephrite into axes and chisels, use for coarser work, such as felling trees, and house and boat building, tools of the weight of six or eight pounds, while those used for carving in wood only weigh as many ounces. They have, however, to be sharpened nearly every moment, so that the workman always has standing by him a stone and a cocca-nut shell full of water. In felling timber many axes are spoiled, and yet with these very tools they work and finish off their large canoes, made out of trees eight feet in diameter and forty feet long, and they split the trunks into planks, which they work, or plane, as it were, so skilfully, that they can take off quite thin strips without a false stroke.

In Dominica also, according to Dr. James Clarke, the Caribs are accustomed to cut down large trees with stone hatchets.[2]

Stone Hammers.—Three stone hammers were found at Meilen. Of these one is drawn (Plate II. fig. 9); it consists of very hard and tough stone like serpentine; one end is wedge-shaped and the other has been ground flat. In the middle or thickest part of the tool is a circular helve hole of the same width throughout, which has been brought to a fine polish; it was bored so accurately that no workman of the present day could do better. The second drawn (Plate II. fig. 6) is formed apparently for hammering only, and is a cylindrically shaped tool, in one place bored entirely through, and in another only partially so. The holes are not everywhere equally wide, and it is very evident that the tool used to bore the stone had an uncertain (or what the workmen called a 'wobbling') motion. It is remarkable, however, that in the partial boring, a projecting point has been left standing at the bottom of the hole, which undoubtedly indicates the employment of some kind of tube as the boring tool.[1]

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[1] 'Jactant Angli cuspides ac diversorum generum tela, sævissimas quoque secures et *lignis imposita saxa.*' William of Poictiers in the History of William the Conqueror (see Caumont, Cours d'Antiquités, vol. i. p. 221).

[2] Archæol. xv. p. 408.—Klemm's Handbuch, p. 154.

The third hammer is of very pretty spotted serpentine, rather soft, and it has been bored first by making some kind of a hole and then widening it with an instrument which worked like a file. The face is intentionally rounded, and all the four sides are carefully polished. (Plate II. fig. 10.)

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[1] Unless we consider that this hammer was bored in the later days of the settlement when bronze had in some measure come into use, and thus imagine that a metal tube had been employed, we are almost obliged to believe that some implement of flint must have been required which was either naturally or artificially somewhat in the form of a tube or cylinder. In most countries where chalk is found there are certain fossil sponges enveloped in hard black flint, but with the centre, containing the organic remains, very soft and friable; in some cases the sponge has disappeared and the flint is actually hollow. Now where the sponge is of a lengthened form, or at any rate has a slender stalk, a portion broken off would virtually for all practical purposes be a small cylinder of flint, and if fastened to a pole and made to revolve by a bow and cord would form with the addition of sand and water a very efficient tool. Sponges of this form are said not to be found in Switzerland, but they occur plentifully in France and England. It has been shown in a treatise of Gutsmuths ('Morgenblatt,' No. 253, 1832) entitled 'How the ancient German bored his battle-axe,' that a similar plan was adopted in the bronze age, by fitting to a cylinder of metal, probably of bronze, a wooden staff which was made to revolve rapidly by a bow and cord. A friend well acquainted with the processes used in engraving 'hard stones' is of opinion that these curious cuttings may have been produced (supposing metal at that time to have been unknown) by the revolution of a *hollow* stick, a piece of elder-wood, for instance, turned like a drill and supplied with sharp sand and water. The circumference taking up the cutting particles would act on the stone exactly as a similar tool of soft metal, only it would require more frequent renewing. This is something more than mere theory, for La Chaux observes that Guay, to give the last finish to his elaborate cameo portrait of Louis XV., worked the diamond powder into the minuter lines of the work, not otherwise accessible, with the point of a *quill*. As for the use of a hollow cylinder in cutting large openings in gems, De Boot, writing in 1600, figures amongst other instruments of the lapidary one then generally employed, where it was advantageous to save the excised portions of the material as well as labour and emery powder; for example, where a gem (carbuncle or lapis lazuli) had to be hollowed out into a cup. This instrument was a thin brass tube of considerable relative diameter; it was fixed to a stalk, driven by means of a strap and wheel, and acted in a vertical direction upon the material, being pressed down by a heavy weight applied above. The several '*cores*' as they were formed, were removed by means of a differently shaped tool; for in the case in question the perforation necessarily was bounded by the bottom of the intended vase.—[Tr.]

Flint Implements.—In France, Germany, and the Scandinavian countries, flint implements are met with in great numbers in the shape of knives, saws, sickles, arrow and lance heads, hammers, &c.; but in Switzerland very few have been found. Ancient burials, which in the above-named countries often yield abundance of these objects, have to the best of our knowledge hardly afforded us a dozen flint implements. The reason of this is that the raw material or nodular flint found in the beds of chalk is not met with in Switzerland, and hence the larger flint implements which are discovered there are to be considered as imported materials. The greater part of the flint found in Switzerland, made into tools, as far as can be judged from the nature and colour of the material, has been brought from France. The settlement at Meilen is therefore of great interest, as it is a tolerably productive locality for flint implements, though they are remarkable neither for variety of form, nor for beauty of workmanship.

Our collection has furnished the following specimens:—

1. A number of rather long tongue-shaped pieces, which are quite flat on one side, and on the other there is a flat plane sloping off to the edges so as to form on each side narrow flat surfaces the whole length. These implements are from five to six inches long; one end is pointed, the other is blunt. It is not easy to decide whether they were used as lance points, for which their form seems so well adapted, or for saws; their serrated edges would make them very useful tools of this description. (Plate III. fig. 2.)

2. Several flakes three inches long and one and a quarter inch broad, flat on one side, and on the other having a sharp ridge shelving off to the edges on each side, and thus making two flat surfaces the whole length. Two specimens of this kind were found arranged in a very remarkable manner, which leaves no doubt whatever as to their use. One edge, in fact, is inserted in a piece of yew wood, of the form of a weaver's shuttle, as in a kind of sheath, and is fastened into it with asphalt or mineral pitch: this arrangement was first observed in this settlement. These instruments were doubtless used as small saws, and the wooden backs made them easy to hold,[1] and prevented the hand from being wounded when pressed sharply down. (Plate III. fig. 1.)

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[1] 'Nordisk Tidsskrift,' vol. i. part ii. fig. 22. In order to give strength to this piece

3. A number of arrow-heads, only one of which, however, showed any good workmanship. (Plate III. fig. 22.)

4. Several pieces of flint, the form of which shows that they were used as knives. (Plate III. fig. 3.) The size varies from two to six inches.

5. Small flakes with very fine and uncommonly sharp edges running to a point, which were used as cutting instruments; a great many flakes had quite the appearance of refuse or chips, which must have occurred in manufacturing the flint implements.

Grinding Stones.—Slabs of sandstone have been found, which evidently, from the marks upon them, had been used for grinding and sharpening the stone celts.[1] One of them is drawn (Plate III. fig. 23). Several prismatic pieces of sandstone such as that drawn (Plate III. fig. 5) have also served for grinding and whetting.

Awls or Piercers.—Under this class of instruments we may place two small oblong plates, one made of a green kind of nephrite (Beilstein), nearly five inches long, and six lines broad, the other of the red slate of the district, as broad as the first, but much shorter. Both plates are perforated at one end, and by constant use have been brought to a smooth surface. (Plate III. fig. 4.)[2]

Corncrushers and Mealing Stones.—Following the example of the northern antiquaries, we class under this head certain roundish stones, the size of a man's fist, made out of very hard rolled sandstone, and with certain hollows and flattened surfaces; the whole of them have been hewn and roughened on two opposite sides by blows with a pointed instrument.[3] They vary in form to some extent; some are like an orange, others like a ball with depressions on the four opposite sides. (Plate II. figs. 7 and 8.) Some doubt might possibly have arisen as to the correctness of the name given above, and they might have been considered merely as a kind of hammer, had not a sandstone been found, made with a circular cavity into which these stones fitted, and thus pretty nearly proved the use above assigned to them. The 'mealing stone' drawn in the plate of

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of serrated flint, it was *probably* set in wood in such a way that only a small part with the teeth projected.

[1] Compare 'Nordisk Tidsskrift,' vol. i. part ii. and 'Urda, a norsk antiquarisk-historisk Tidsskrift,' vol. i. part i. where a similar implement is described.

[2] This is as the passage stands in the original, but possibly 'polishing stones' might have been the more correct designation.—[Tr.]

[3] 'Nordisk Tidsskrift,' vol. i. part ii.

objects from Nidau (Plate XXXVIII. fig. 5), was in fact from Meilen; but these objects in the two settlements are so precisely similar that one sketch will answer for both. Both stones together consequently formed a stamping and grinding machine, which was used for crushing corn before the invention of handmills. Some corncrushers consist merely of cylindrical unworked rolled stones, both ends of which were made rough. (Plate II. fig. 11.)

Since the above notice was published in the first report on lake dwellings to the Zürich Antiquarian Association, a volume has appeared, which is of great interest, as it throws much light on the manners and customs of the savage nations of Africa.

FIG. 9.

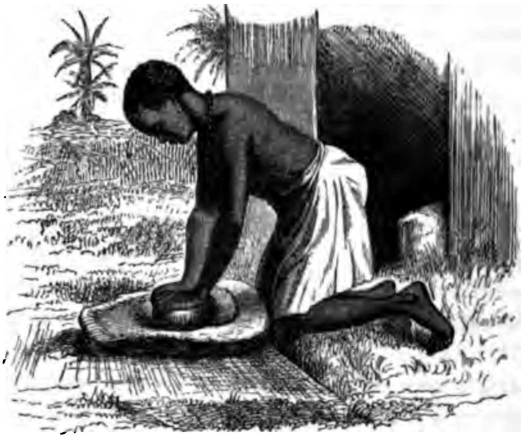
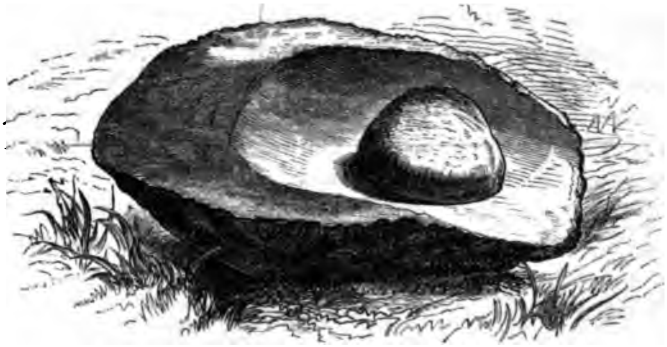


FIG. 10.



The work in question is a 'Narrative of an Expedition to the Zambesi and its Tributaries,' by David and Charles Livingstone, London, 1865. Amongst other things the drawings on pages 543 and 544 are very remarkable, as they represent mealing stones and corncrushers which are actually in use at the present day, and which are identical with those of the lake dwellings. The drawing of the woman at work with these implements (figs. 9 and 10[1]) might be given as the representation of a lake-dweller similarly employed. 'The mill,' say the travellers, 'consists of a block of granite, syenite, or even mica-schist, fifteen or eighteen inches square, and five or six thick, with a piece of quartz or other hard rock about the size of a half brick, one side of which has a convex surface, and fits into a concave hollow in the large and stationary stone. The workwoman kneeling grasps this upper millstone with both hands, and works it backwards and forwards in the hollow of the lower millstone, in the same way that a baker works his dough when pressing it and pushing it from him. The weight of the person is brought to bear on the moveable stone, and while it is pressed and pushed forwards and backwards, one hand supplies every now and then a little grain to be thus at first bruised and then ground on the lower stone, which is placed on the slope, so that the meal when ground falls on to a skin or mat spread for the purpose. This is perhaps the most primitive form of mill, and anterior to that in oriental countries, where two women grind at one mill, and may have been that used by Sarah of old when she entertained the angels.'

Hearth Plates.—Many larger slabs have been found, made of the sandstone of the district, which have been exposed for a length of time to the fire, and burnt to a red colour; they were also partially covered with soot: they can hardly have been used for any other purpose than that we have mentioned.

Lastly, several pieces of fine carbonate of lime were brought up out of the mud with the other objects. It cannot be determined whether they were to have been crushed and mixed, in the shape of grains, with the clay used for making pottery, or whether they had been brought here by the settlers as curiosities.

Objects made of Organic Material. Bone Implements.—These may be classed under three divisions.

1. Small instruments ground into the shape of a chisel, which may have been used for making the earthenware vessels, and more especially the ornamental markings which are found upon them. (Plate III. fig. 25.)

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[1] I have to express my thanks to Mr. Murray, the publisher of Messrs. Livingstone's book, for kindly allowing me to copy these woodcuts.—[Tr.]

2. Needles for knitting, and pins for the hair, or for fastening the clothes. (Plate III. figs. 17, 18.)

3. Various sizes of awls or piercers either with or without an ear. (Plate III. figs. 15, 16, 19, 20, 21.) The awls intended merely for boring were made either out of the leg bones of some small animal, in which case one end remained in its natural state and served for a handle, or out of the ribs of stags and boars; those of the latter sort would naturally be flat and somewhat bent, and were probably used also as arrow heads, for which they were very well adapted.

Implements of Stag's Horn.—Three tools like hammers or mallets. All three were made out of the main branch of the horn; a piece was cut off from six to eight inches long, and a hole was made in it for the insertion of a handle. One of them is neatly polished, the second is remarkable for the skill shown in the helve hole (Plate II. fig. 5), and in the third the helve hole runs not straight, but obliquely, through the horn (Plate II. fig. 1). This hammer is ground and sharpened at one end, and might be used as a hatchet. The polished specimen was the only one in which any portion of the handle remained. These tools are so worn down that it is difficult to determine their actual use.

The remaining implements of horn were several awls or piercers of different sizes, and the handles of the chisels already described.

Implements of Boar's Teeth.—Useful notching or cutting instruments were very simply and easily made out of these materials. Large boar's teeth, either whole or split in two, were ground sharp at one end, so that the enamel of the tooth formed the edge of the knife. These specimens very much resemble shoemakers' knives, and doubtless were used for cutting skins and leather. About half-a-dozen specimens have been preserved; some of them were perforated at one end. (Plate III. figs. 10, 11.)[1]

Implements of Bear's Teeth.—Several specimens have been found of the large teeth or tusks of bears, brought to a point at the fang, and perforated near the end: they are also very finely polished. The fishermen think that these teeth were used for making fishing nets (Plate III. fig. 6). Or were they worn as ornaments or amulets? Similar objects have been found at Concise and other lake dwellings.

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[1] Archæologia, xxx. p. 333.—In a barrow of South Dorsetshire were deposited a deer's antler, a spear-head of stone, an arrow-head of flint, and the tusk of a boar. A hole was nicely drilled through this tusk, and it had probably been worn suspended from the neck. Also Archæologia, xv. 122.—In a Wiltshire tumulus, several perforated boar's teeth were found.

Animal Remains.—During the excavations the attention of the workmen was strongly excited by the great number of loose bones of wild boars and stags, particularly by the abundance and size of well preserved stag's horns and boar's tusks. Amongst a heap of things of this kind there were, as before mentioned, the horn of an ibex, and the skull of a fox, and the remains of domestic animals in abundance, such as those of the cow, the sheep, and the dog, besides a few human remains, as a skull and portions of ribs which have been already referred to. It should be remarked also, that a considerable number of the stag's horns were cut into pieces, or the main stem has been separated from the branches by cutting instruments of stone, and that marks of this operation and incisions were to be seen on nearly every portion of bone.

Amber.—A single bead of this material was found exactly like the beads used for neck ornaments, which are met with not uncommonly in ancient graves. (Plate III. fig. 8.)

Wood.—An oak club, of which a sketch is given (Plate III. fig. 14), also a number of charred boards, originally split out of the trunk, but partially hewn or hacked with stone celts. Charcoal and half-burnt pieces of oak, beech, and firwood were found very generally, and in great abundance. A part of this burnt wood belonged undoubtedly to the dwellings themselves, which were clearly destroyed by fire; the rest probably is the refuse of the wood used on the hearths, for that the settlers had hearths in these lake dwellings is proved both by the hearthstones actually found, and also by the appearance and condition of the cooking utensils.

Metal.—The only two objects in metal found here were the armilla made out of thin bronze plate or flat wire (Plate III. fig. 12), and the bronze celt found by Colonel Schwab in his subsequent excavation (Plate III. fig. 26). No implements of iron were noticed here, at least none were preserved.

Utensils made out of Clay.—The pottery which has been found here in tolerable abundance perfectly resembles in material, shape, and mode of working, the specimens dug out of tumuli. No whole vessels unfortunately were discovered, but some fragments were so large and well preserved that we can perfectly understand their form and mode of manufacture.[1] An examination of these specimens shows that there were two kinds of pottery, one extremely coarse, and the other far better in every respect. The potters' wheel was not used in any case, but all the vessels were made by the hand alone, aided by moulding and scraping tools, and for this reason they exhibit a good many bulges and lumps, and the sides are of unequal thickness; they have also been ill burnt, and in an open fire, so that the mass did not harden properly, and does not ring when struck. By far the larger proportion are specimens of coarse workmanship, and are portions of great vessels with a wide mouth, and an average diameter of from seven to thirteen inches in the bulge, which would hold from two to seven quarts. (Plate III. figs. 7, 9, 24, 27.) They were not made of purified clay, but of common unwashed loam, in which quantities of grains of broken gravel and granite were kneaded, some of which are the size of a bean.[1]

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[1] My attention has been drawn by a classical friend to a passage which bears on hand-made pottery. He says, 'In turning over Athenæus the other day I came upon a

This mixture, according to the opinion of those who understand the art of pottery, was useful not merely for making the vessels durable, but for enabling them to resist the fire. It is very certain that they were used as pipkins over the fire, for in many specimens the lower part of the outside is blackened with soot, and injured by the heat, just like the pipkins used on our modern hearths. In several cases the inside, as well as the outside, was covered over with thick firm soot, a fact which renders it difficult to say to what use they were applied, unless, indeed, we consider what was inside to be the charred remains

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notice of *hand-made* pottery which from its late date (under Severus) may perhaps interest you. "A peculiar kind of cups are made in the native place of our fellow-guest Athenæus, *Naucrates*; for they are shaped like bowls (*phialæ*), and made not on the *wheel* but as it were by the finger, and have four ears (handles) each, and the base spread out wide. The potters dip them (i.e. glaze them) so that they look as if silvered over." '—[Tr.]

[1] The following extract from the 'Times' newspaper of Sept. 15, 1876, may not be uninteresting. It describes the process of pottery by the hand alone, at Fiji, and is by an eye-witness. 'A little shrivelled old woman was making an earthenware vessel nearly as large as herself with no other implements than a round flattened pebble about four inches in diameter, and a piece of wood about as large as the back of an ordinary hair brush, slightly concave on the surface. Dipping both stone and wood frequently in water she moulded the inside of the huge pot with the former and patted the outside into shape simultaneously with the latter. The vessel was egg-shaped, the opening being at the top or large end of the egg, with an everted lip. It was nearly three feet in height and two in diameter, and was formed of clay found near the village. When it is complete a fire is built round it on the ground, and it is carefully baked before being removed. In the houses we saw several pots of the kind in use. They are placed on their side with the mouth inclined slightly upwards, and are seldom exposed to the risk of breakage by removal from their site. They are, of course, very fragile, but in the hands of the natives they are said to last for years.

of the food or porridge, which was actually in these vessels when the settlement was burnt. Small portions of the fresh-water mussels found in great number in this bay, and which still remain in the substance of the clay, as well as other indications, show that the loam used was from the immediate neighbourhood. It seems probable also that the place of manufacture was at no great distance, from the fact of a quantity of broken gravel and crumbled granite, together with lumps of black lead and ruddle or red chalk, having been taken out of the mud; the two first of which were constituent parts of the material for pottery, and the other two were used for colouring and ornamenting the vessels when made. It is a striking fact that the innate tendency in man to produce in whatever he makes some variety in form or ornament, manifests itself even in these coarse manufactures. No two specimens have exactly the same form, and besides being coloured, they have ornaments on the upper part either impressed or in relief. The ornamentation of fig. 7 appears to be rare; we have not met with it again in any other specimen amongst the large quantity of ornamented pottery brought to light in our excavation. It has in fact been produced by a rope of two thick strands, twisted together, having been wrapped round the neck of the vessel while the clay was yet moist, and then pressed in upon it.[1]

While the coarser kinds of pottery just described may have been used for cooking, and for keeping provisions and other substances, the better kind consisting of vessels like bowls or dishes, were doubtless used for eating and drinking. This finer sort was not indeed made of purified clay, but was manufactured simply with much greater care; both inside and outside the vessels were neatly smoothed, and the outside was rubbed with graphite, and polished. The substance of the vessels in proportion to their size is extraordinarily thin; in some specimens there are ears through which cords might be passed for the purpose of carrying them.

Spindle Whorls.—A few of these implements have been found made of clay, one kind thicker than the other; they are exactly like those found in ancient graves (Plate III. fig. 13).[2]

Hazel Nuts.—The only things found here of the vegetable kingdom which were used for food were hazel nuts, of which a large number were met with in the relic-bed, all of them cracked, so that in all probability they had not been brought here merely by chance floods.

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[1] Two pieces of pottery with the same ornamentation have been found at Robenhausen.

[2] According to Pliny, 'Hist. Nat.' xix. 1, flax had in early times spread through the whole of Gaul.

A number of fir-twigs, fir-cones, and leaves of oak and beech in the same bed, seem to indicate that in the early ages the shores of the lake were well clothed with forest trees.

THE LAKE OF MOOSSEEDORF NEAR BERN.

THE settlement in this lake is peculiarly interesting on several accounts: it affords the most perfect example of a regular lake dwelling of the stone period, for no implement of metal has been in it; and from the lake having been artificially lowered, a great proportion of the piles standing near the bank were laid dry. Many circumstances as to the structure were brought to light, and a large number of implements of a very early age were discovered, together with a considerable quantity of animal remains, some of which certainly belong to domestic varieties.

The little lake of Moosseedorf, distant about two hours' walk from Bern, belongs, as its name imports, to that numerous class of lakes in Switzerland called 'Moor lakes.' Its banks are boggy, the bottom is muddy, and the water is thick in summer. Like the rest of the small lakes of Northern Switzerland, it is frozen over every winter. After the water level had been lowered about eight feet in the winter of 1855-6, the remains of two settlements were discovered, one at the east and the other at the western extremity. They were investigated by Mr. Albert Jahn of Bern, and Dr. Uhlmann of Münchenbuchsee, and were described by them with great accuracy in a monograph entitled 'Die Pfahlbau-Alterthümer in Moosseedorf, Bern, 1857.'

Before proceeding to the description of the eastern settlement (which was the only one that could be thoroughly examined), it may be well to give the substance of a report by Dr. Uhlmann on the geological conditions of the immediate neighbourhood. The lake lies nearly east and west in a valley having the same direction. Its present banks consist of meadow land and peat, which is almost changing into black mould; the upper part of this peat is mixed with wood and less dense than the lower part, which is more compact; it varies in thickness from one to two feet, to six feet and upwards. Below this lies the original lake bottom composed of shell marl (weisser Grund, blanc fond), a stratum of bluish-white, soft, calcareous matter, with numbers of snail shells whole and broken. This bed is from one to ten feet thick.[1] Under this shell-marl is found an alluvial mass of sand, gravel, &c., resting on the 'Molasse,' or sandstone of the district. The hills on the north and south sides, which are from 100 to 150 feet high, are either arable or forest land, and consist of regular soil and gravel, below which is the Molasse. No trace of either peat or shell-marl is found here.

The views of Dr. Uhlmann as to the geological sequence of events in this district may be given in a few words. The bottom of the lake was formed by an accumulation of rounded pebbles and sand from the Molasse of the surrounding hills brought down by floods; the water of the lake was probably muddy from the clay which had also been washed down, and the disintegration of some of the pebbles; and a bed was gradually formed at this period consisting in a great measure of the remains of shells then living, which is well known as the 'shell-marl' (weisser Grund, blanc fond) of most of the Swiss lakes. While this was accumulating a considerable time must have elapsed; till by floods, or other causes, an accumulation of sand and alluvium took place at the eastern extremity of the lake—the level of the water rose, and thus the formation of peat first began. It rested on the shell-marl, and consisted in general of wood broken to pieces, branches, &c., mixed with mud, sand, and stones. As the peat increased, the outlet of the water diminished. The valley became more and more boggy; the peat was formed in the usual manner round about the lake and in the bog to the westward. This condition of things remained till very lately, when by an artificial drain the surface of the water was considerably lowered, and the valley was freed from bog. The formation of peat has now ceased, and the level of the lake lies at the present moment probably some feet lower than in the time of the inhabitants of the lake dwelling.

The little map (Plate IV. fig. 1) will give a general idea of the locality. The eastern settlement marked E, or at least its site, is now in a great measure on dry land: it formed a parallelogram of piles driven irregularly into the muddy bottom, and was about fifty-five feet broad, and seventy feet long. The piles consist of stems of fir, oak, birch, and aspen, being the kinds of wood found in the neighbourhood: they are from five to seven inches in thickness; some whole, some split, and many with the bark still remaining. Cross branches laid on the bottom in the manner of a fagot bank, or fagot road, appear like the remains of a bridge or stage connecting the settlement with the shore. Here, as in many other lake dwellings, the upper structure had been destroyed by fire, and only the burnt wood remained. It was very singular that the implements and utensils found amongst the remains of this settlement were met with, not in the mud of the ancient lake bottom, but in the bed above it, called the relic bed, which consists of loose peat, with sand, stones, clay, wood, and charcoal, and varies in thickness from five inches to two feet or more. Many of the implements, the products of human art, lie in this bed very near to the shell-marl, but none of them actually in it, except where the marl is soft and pulpy, so that it naturally follows that they had fallen into the peat which had been gradually accumulating during the existence of these habitations. A very striking circumstance, however, ought to be mentioned, namely, that even heavy implements, such as stone chisels, grinding or sharpening stones, &c., were found quite high in the relic bed, while lighter objects, such as those made out of bone, were met with much deeper.

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[1] When Dr. Uhlmann was kind enough to show me his collection in 1864, he mentioned that in this shell-marl many of the specimens of *Limnæa palustris* and *L. stagnalis*, especially the latter, were larger than those of the present day. He also stated, if I mistake not, that the marl contains *Limnæa auricularis*, and a species of *Paludina*, now extinct in the *smaller* lakes.—[Tr.]

The meaning of the various letters on the map will be found in the explanation of the plates.

Plate IV. fig. 2, shows the arrangement of the piles on a part of the setttlement; the space comprised within the letters *a a*, *c c*, is now lying dry.

Fig. 3 is a section which, as well as the ground plan, has been drawn by Dr. Uhlmann, and exhibits the different beds or layers of soil on the bank, together with the piles. The line A represents the ancient level of the water; the line B the present level; *b b* a bed of mud with roots of reeds, but without any artificial objects in it; *c c* is the relic bed, consisting of loose peat, with many stones, gravel, wood, charcoal, bones, &c., and containing the various implements found here—the piles pass through this bed into the lower one; *d d*, the ancient bed of the lake, consisting of loam and mud, with the remains of shells; *e* is compact peat; and *a a* is the top of the present bank.

The vignette, fig. 22, Plate V., will give some idea of the appearance of the lake of Moosseedorf; the sketch was taken standing on the site of the lake dwelling just described. The canal cut to drain the lake may be seen to the right, and is marked by two birds.

A few of the antiquities found here are drawn on the same plate and will now be described.

Plate V. fig. 1. Hafting for a stone celt made of fir-wood.

Fig. 2. Hafting for a celt made of stag's horn.

Fig. 3. Harpoon of stag's horn; some harpoons in the collection of Dr. Uhlmann are double-barbed—that is, each main barb has two points.

Fig. 4. A lance point made out of the shoulder-blade of some large animal.

Fig. 5. Flint saw set in a handle of fir-wood and fastened with asphalt.

Figs. 6 and 7. Needles made of boars' teeth, probably for sewing the garments together.

Fig. 8. Awl made of one of the leg bones of the roe.

Fig 9. Bone knife with a sharp edge.

Fig. 10. Chisel made of a stag's leg-bone.

Figs. 11 and 12. Two views of a wedge made of fir-wood worked very neatly.

Fig. 13. Bone awl or piercer.

Fig. 14. Fish-hook made of the tusk of a wild boar.

Fig. 15. Boar's tusk ground to a sharp edge like that of a knife on the convex side, and with two perforations.

Fig. 16. Needle or pin made of a boar's tusk.

Figs. 17 and 19. Flint flakes, probably for scaling fishes.

Fig. 18. Arrow-head of rock crystal.

Fig. 20. Celt of nephrite, sharp enough to cut skin or leather.

Fig. 21. Comb made of yew-wood two inches and a half broad, and nearly five inches long; it is ornamented with two buttons or projections on one side, and was probably used as a comb for keeping up the hair.

Several of the specimens lately found here are drawn on Plates XIV. and XXII.

Plate XIV. fig. 12. A boar's tusk ground to an edge towards the point, and perforated in two places.

Fig. 21. A bone awl with a head or handle made of asphalt.

Fig. 22. A bone knife.

Fig. 25. A bone tool pointed at one end and with the other terminating in pincers.

Plate XXII. fig. 1. An arrow-head of bone beautifully formed and very finely serrated; the only specimen of the kind which has come under my notice.

Figs. 4 and 25. The antler of a stag neatly polished, perforated at the top, hollowed out below, with a number of perforations all around it.

Fig. 5. Fish-hook made of a boar's tusk; it was manufactured in the following manner: two holes were bored through it, the space between them was cleared away, and the whole was then finished by scraping tools.

The bones of animals, especially those of large ones, were uncommonly numerous, and it is worthy of note that the carcases appear to have been cut up as if by a butcher, for on many of the bones, when taken fresh from the peat, might be seen marks of the stone axes and knives, and the incisions made by the saws. Other bones had the appearance of having been gnawed by carnivorous animals, probably dogs. One of the uses to which the long bones of animals were applied is singular. Plate CL. fig. 6 is the sketch of a skate made out of the long bone of a horse. It is between ten and eleven inches long. On one side it has the natural appearance of the bone, but on the other there is a flat polished surface nearly nine inches long and about half an inch wide. There are no perforations in the bone, but there are two incisions in front and two projections behind, which would allow of its being fastened to the foot. This specimen was first published by Messrs. Albert Jahn and Dr. Uhlmann in 1857 (Bern), and subsequently in several other quarters.

Amongst the fragments of pottery found here may be mentioned the portion of a cup with the rim or edge turned over, in which are two perforations, evidently to pass a cord through for suspension. Another fragment of the edge of a cup has a regular row of perforations placed horizontally. Another portion has an upright projection or boss on the side, about twice as long as it is broad, and perforated vertically; this has evidently been also used for suspension. Two fragments of a broken vessel were joined together by means of asphalt and ashes run through holes drilled on each side of the fracture. Some of the earthenware vessels must have been of large size. One fragment describes the segment of a circle which if completed would have been sixteen or seventeen inches in diameter; the edge is thickened, and the top is marked by depressions, about five in a space of three inches, apparently scooped out by the back of the nail of the little finger. Many of the fragments of pottery were covered with a crust of soot either inside or outside.

A notice of the remains of animals and plants from this settlement will be found in the results of the investigations by Professor Rütimeyer and Professor Heer towards the close of this volume, and it is therefore needless to give the list here. It may, however, be well to mention that remains of the hare have been found here: from the very great rarity of this animal in the lake dwellings, this fact is a matter of some interest. Burnt wheat and barley have also been found here: and the *Trapa natans*, or water-chestnut, which does not grow in the lake at the present day. Linseed has also been met with, showing that the cultivation of flax was probably general in the stone age.

In connection with the settlement of Moosseedorf, a discovery made in the immediate neighbourhood is well worthy of attention. Every little hillock in the surrounding marshland, still partially covered with peat and hardly rising above its level, appears to have been a place where flint was worked into implements, for nothing else but flint was found in any of them except some broken white pebble-stones and traces of charcoal; more than a thousand pieces of flint in flakes, cores, or implements intended for some special purpose, cracked off in all sorts of ways, and afterwards hammered to the required shape, were found in these localities. The flakes are found of various sizes, from that of fish-scales up to two inches in length. More or less care was bestowed upon them according to the use for which they were intended. The majority consisted of what may be called plates, rather long and with a sharp cutting edge, and which by further manipulation could be made into little knives, scrapers, saws, and piercers, as well as into the heads of arrows. Dr. Uhlmann says that he has not yet ascertained the use of the small four-cornered specimens.

The colour of these flints is as varied as their form; they are found white, brown, black, red, and bluish, of all shades, also translucent and like agate and chalcedony. The greater part appear to have come from the Swiss Jura (chalk), some few from the Alps. Those of a better kind of stone are doubtless of foreign origin.

The tools used for making these flint implements do not seem to have been of the same material, but of gabbro, a bluish-green and very hard and tough kind of stone. Several of these implements have been met with; their form is very simple, and varies between a cube and an oval. The oval specimens were ground down in one or two places, and the most pointed part was used for hammering.

LAKE OF PFÄFFIKON.

ROBENHAUSEN AND IRGENHAUSEN.

These settlements on the lake of Pfäffikon may conveniently be described together, though the greater part of the interest will be centred in Robenhausen. The little map (fig. 1) at the top of Plate VI. will give an idea of this lake, both as it existed formerly and in its present dimensions. The peat has formed all round it, and, especially on the south side, has encroached materially upon the water. The sketch given, Plate VII. will show the general appearance of this peat moor, the high mountains of Glarus forming a background to the view. The Aa brook, hereafter to be mentioned, runs through the middle of the moor, and the settlement of Robenhausen is intersected by this stream; the exact locality is marked on the sketch by a dark bird.

We learn more about the domestic arrangements of the inhabitants of these early dwellings from the settlements buried in peat moors than from those where the remains are found in the shallows of our lakes. For although in the latter we can readily obtain an idea of the number and arrangement of the piles, and probably of the extent and divisions of the whole settlement, and some portions of the relics are perhaps more easily secured, yet, on the other hand, the excavations in the peat moors enable us to ascertain facts which bear upon the original conditions of these abodes, their development and their destruction. By systematically excavating the settlements in the peat moors, we not only obtain more correct information as to the construction of the pile work, the form, mode of erection, and size of the huts, but we even get a glance into the interior. Wonderful to relate, we can walk over the very flooring of these dwellings, abandoned thousands of years ago. We see before us their hearths and their various household utensils. We obtain information as to the industrial habits of the people, the nature of their food, and the mode in which they were clothed. It is only by the investigation of these singular remains that we can hope to extend our knowledge as to the peculiar object of these settlements, and the degree of civilisation attained by their inhabitants.

Amongst all the settlements found in peat moors, that of Robenhausen in all these respects unquestionably takes the first rank. When the dwelling was first erected, a bed of peat had already begun to form, which was increased both by alluvial organic matter, and by the growth of lake weeds in the stagnant water, amongst the forest of piles; and thus this bed treasured up, as it were, in its bosom all the implements which fell into the water when the floorings gave way, and also the different relic beds belonging to the successive settlements, all in their regular order. Circumstances so favourable to the investigation are not to be found together in any other lake dwelling.

Another fact also is of the greatest importance, both as to the preservation of the antiquities and as to our accurate knowledge of this locality. The greater part of the area of the settlement is the property of one individual, who devotes his time and powers to this scientific inquiry, and gives himself up to the work with an energy and perseverance which deserve the highest praise, more especially as it has to be carried on under many difficulties, and frequently is a trial even to health. This energetic individual is Mr. Jacob Messikomer of Stegen Wetzikon.

Some years ago the inhabitants of this district, when cutting peat in the neighbourhood of Robenhausen, found implements for fishing and other purposes, which led them to conclude that the marshy ground south of the lake of Pfäffikon, and through which the Aa brook flows, was formerly under water, and had gradually been raised. This opinion was confirmed by the discovery of the remains of an extensive lake dwelling in January 1858 by Mr. Jacob Messikomer, in that part of the moor which goes by the name of Himeri. Excavations were commenced on a small scale by the Antiquarian Association of Zürich, and subsequently the works connected with the outlet of the water gave great facilities for the investigation. The examination of this remarkable settlement was undertaken by Mr. Messikomer, and we are indebted to him for an accurate account of the size of the settlement, the construction of the dwellings, and for notices of the antiquities found here. His later excavations have brought to light many interesting remains, amongst which are some which throw considerable light on the age of this colony. Almost up to the present time it has been considered as a settlement purely of the stone age—no traces whatever of metal having been found in it; but it will be seen from the description of some of the earthenware vessels lately met with, that this opinion must in some measure be modified.

As before mentioned, the lake dwelling of Robenhausen is situated in the peat moor on the southern side of the lake of Pfäffikon. (See Plate VI. fig. 1.) The space covered with piles is nearly three acres; it forms an irregular quadrangle about 2,000 paces from the ancient western shore of the lake, the whole of this distance now consisting of peat, and about 3,000 from the shore in the opposite direction. It was with this last-named side that the settlement, which of course was formerly entirely surrounded with water, communicated by means of a bridge or stage, of which the piles are still visible. The reason why the communication with the land was made in this direction, and not on the side where the land was nearer, appears to be that the gardens and pastures of the colony lay in the sunny district of the village of Kempten, a name evidently allied to Campodunum, and of Celtic origin.

The substructure of these dwellings was as usual of piles, consisting partly of whole and partly of split stems ten or eleven feet long, of oak, beech, and pine-wood, sharpened at the end with stone celts or hatchets, and driven a few feet deep into the mud at a distance of from two to three feet apart. Later discoveries, it will be seen, enabled Mr. Messikomer to distinguish the piles of the different settlements by the nature of the wood. The floor or platform supporting the huts was formed, as is evident from the remains still existing, partly of cross-timbers and partly of boards, which were fastened to the upright piles by wooden pins.

The outermost piles are bound together with wattle or hurdle-work of branches, forming a kind of defence for the settlement. Large pieces of this hurdle-work have been met with.

The Aa brook, now called the Aa canal, or the outlet of the lake, which some years ago was artificially widened and deepened, runs immediately through the settlement. It is twenty-seven feet broad, and from eight to nine feet deep, and the bed of it is thickly set with the stumps of piles placed in double rows, which were broken when this watercourse was put in order. Plate VI. fig. 4 gives a section of this canal, showing the beds of peat, the relic bed, with the floorings made of gravel and clay, and also the remains of the piles themselves.

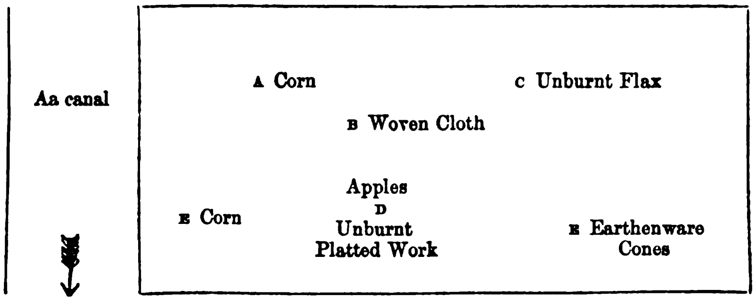
Fig. 3 gives an enlarged section of the relic bed. It is singular that very good peat is found both under and above the floorings, and that wheat, barley, flax, string, woven cloth, &c., are found in the very substance of them. Fig. 2 shows the ground plan of a portion of the canal about sixty feet long; the arrangement of the piles is shown by small circles, and the localities are also noted where the different antiquities were found—at least, where they were of especial interest, either from the quantity found together, or from the nature of the objects themselves. Single specimens of woven or platted cloth are not mentioned, nor are the localities indicated where pottery was found, nor animal remains which had served for food; all of which were found in abundance, and probably were thrown into the water through some of the numerous openings so conveniently at hand in the timber platform of the lake dwelling. In like manner, the places are not noted where remains of berries, cracked nuts, bones and scales of fishes were met with, all of which were found lying together in great quantities, and had evidently been thrown into the water by the same holes. No notice also is taken of charcoal, which in fact is spread over the whole area. A curious fact is that in many cases objects are found together which have a certain mutual relation. In one place a considerable quantity of corn (wheat and barley) was found together with bread; in another locality these articles of food were found together with burnt apples and pears; in a third, flax and its different manufactures; and in a fourth, these very things were discovered together with the earthenware cones used for the loom. There can be no doubt that in the first-named two localities there were store-houses of different kinds of grain, and that in this very place the corn was bruised and ground, and afterwards either boiled in pots to a kind of porridge or made into dough with water without separating the bran, and then baked into a kind of cake or bread on hot rounded stones, and under the glowing embers. The large number of granite slabs used for mealing or grinding stones, and found together with the objects last mentioned, prove that the manufacture of meal was carried on here to a considerable extent. The third and fourth localities indicate a large store of flax, which is found here sometimes in skeins, or hanks, sometimes spun, platted, or woven in the form of threads, cords, nets, mats, and cloth, just as in a linen-merchant's warehouse.

Stone celts, with or without hafting, arrow-heads, and other flint implements are found in abundance scattered on the bed of the canal, but to the present time no place where the implements were manufactured has yet been discovered as indicated by refuse flakes and unfinished or imperfect implements.

According to the calculation of Mr. Messikomer, the area of ground examined by him in the canal contains about 4,000 square feet, which is about one-thirtieth part of the whole settlement. At least 100,000 piles must have been used in the whole structure, and if we join to this consideration the fact that the bones and fragments of pottery were so abundant that every shovelful of mud taken from the bottom of the canal at a depth of six or seven feet contained several specimens, and also that the animal remains and the products of human industry here form a bed at least three feet thick, called by us the relic bed, we seem perfectly justified in coming to the conclusion that the settlement lasted many centuries.

Subsequent excavations were made by Mr. Messikomer in an area 100 feet long and 50 feet broad, abutting at right angles on the Aa brook canal, and several new specimens were brought to light, amongst which were one or two perfect long bows like those used by the South Sea Islanders, as well as several imperfect ones: stone celts fixed in wooden clubs; a stone celt fastened in a hafting of stag's horn, which was then fixed in a wooden club, a flint arrow-head fastened to the shaft with cord and asphalt; several implements of maple-wood, such as knives and dishes, some of them perfect and others broken or unfinished; and lastly, a remarkable canoe made out of a single trunk (Einbaum), such as may now be seen still in use on the lakes of Zug and Lucerne, twelve feet long, one and a half foot broad, but only five inches in depth.

The places where these objects were found in the above-mentioned space are shown on the following plan:—



Very few things were found in the space left blank: hardly any of stone or bone, as the chemical nature of the peat is not only to bleach but to disintegrate the stone, and to dissolve the bone entirely. The few bone implements which were at all well preserved were lying on the top of the shell-marl. The following are sections of the ground taken at three of the localities indicated above:—

Section at B.	Section at C.	Section at D.
½ foot Alluvial Earth	½ foot Alluvial Earth	½ foot Alluvial Earth
3 feet Peat	5 feet Peat	5 feet Peat
½ foot Flooring		
2 to 2½ feet Peat		
½ foot Flooring	1 foot Flooring	1 foot Flooring
Woven and Platted Cloth		
½ foot Flooring	2 inches Unburnt Flax Seed Vessels	4 inches Apples and Charcoal
½ foot Relic Bed	½ foot Relic Bed	½ foot Relic Bed
Lake Sand	Lake Sand	Lake Sand

It will be seen that in the section B woven and platted cloth occurs, as was formerly the case in the middle of a bed of earthen flooring one foot thick, while in both the other sections burnt apples and unburnt flax capsules were found under the floor; and very frequently burnt and unburnt platted cloth are found quite close to each other. The existence of a floor may always be considered to indicate a favourable locality for antiquities; though, as was the case at Niederwyl, only the rooms were covered with an earthen flooring; the open spaces around were without it.

Mr. Messikomer, in his reports on this excavation, says that at first he could hardly convince himself of the existence of more than one floor, and could not comprehend how a bed of peat two, or two and a half, feet thick could again be covered with a layer of earth, till at length a full explanation of these singular layers appeared in another part of the settlement. The section given, Plate XVI. fig. 2, taken during this excavation, shows two systems of piles one above the other, the upper ones of course being the later, as they do not go down to the lake bottom, but were only driven into the relic bed of the previous settlement. The heads of the upper or later piles are about two and a half feet higher than those of the others.

Still later excavations have added materially to the interest of this settlement, for we now know not only of two but of three distinct settlements, one over the other. It will probably be the best to give the account of this very singular fact in the words of Mr. Messikomer himself. The following is an extract from a report made by him to the Historical Society of Switzerland, in August 1865:—

'Anyone who takes the trouble of descending into one of the excavations made in the area of this settlement, and at present kept free from water by pumping, will remark, about ten or eleven feet deep under the surface, a bed of a whitish-grey colour, consisting of the remains of innumerable small shells, and here called "Weisser Seegrund" (white lake bottom, or in other words Shell-marl), but in Thurgau it is called "Alb."[1] In this bed no traces of implements are found, but the points of the lowest series of piles have been driven into it. Above this there is a bed about four or five inches thick, greasy and sticky to the touch, arising from the decomposition of the remains of plants, and having the appearance of peat. Implements are found in this bed, but not abundantly. Above this lies a bed of charcoal, arising from the conflagration of the first settlement; it contains grains of barley and wheat, also threads, and pieces of cloth, and fishing-nets, all in beautiful preservation from having been carbonised. From all appearances this first settlement was not of long duration.

'After the catastrophe which had happened to the first dwelling, the colonists erected new homes on the site of their old ones, for above the lowest bed of charcoal we find a bed of peat three feet thick, in which are embedded bones, pottery, &c., and also the material of an ancient flooring. Then follows again a bed of charcoal, with corn, apples, pieces of cloth, bones, pottery, and the usual implements of stone and bone. The huts of this *second* settlement were likewise destroyed by fire, as may be clearly seen by the burnt heads of the second series of piles. This settlement was erected more firmly than the previous one, for the piles are so numerous that on the average there are three or four in every square foot. The length of time also that this settlement lasted was much greater, as the bed of peat formed during its existence was much thicker.

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[1] This 'Seegrund' or shell-marl, which covers the bottom of all the smaller lakes, lying in the low districts, and which varies in thickness from a few inches to some feet, and is occasionally burnt for lime, is to be distinguished from the 'blancfond,' which consists of a whitish crust of carbonate of lime, with which the bottom of the larger lakes is partially covered.

'Above the second bed of ashes a new bed of peat is spread about three feet thick; in this there are also the remains of a flooring, as well as a number of stone celts either broken, half finished, or in good preservation, some of them are of nephrite: pottery was also found here, as well as other things usually met with in lake dwellings. This settlement must have lasted a long time, but seems only to have extended over a part of the whole area. It is a singular fact that while the piles of the two first settlements reach down to the shell-marl, those of the third settlement were driven into the mass of ground or material arising from the two first settlements. The piles of the upper settlement also consist entirely of split trunks of oak, while those of the two lower ones are round stems of soft kinds of wood. It is also remarkable that in the remains of this third erection no signs of any catastrophe by fire are to be discovered, and we may therefore venture to conclude that the colonists, probably compelled by the increase of the peat, left these abodes of their own accord.

'The reason why no corn, apples, or manufactures of flax, are found in the upper layer, may probably be found in the fact that the latest erection was not burnt, for nearly all the specimens of the above descriptions which have come down to us are in a carbonised condition.

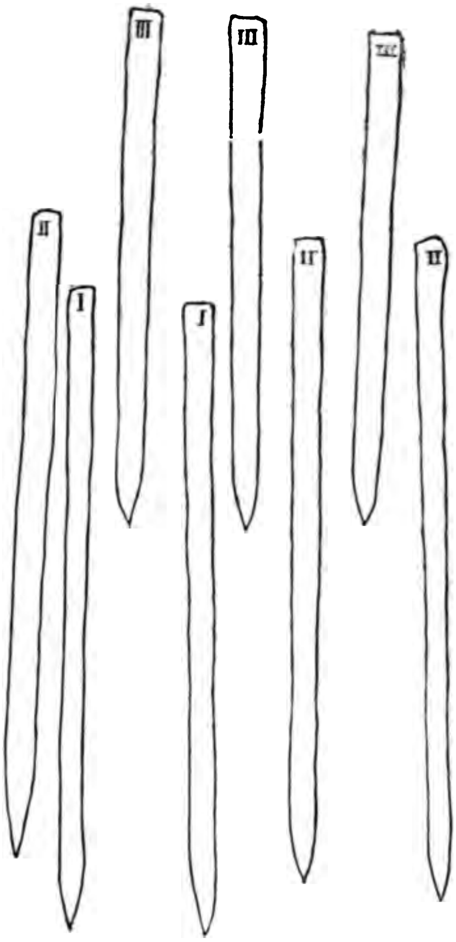
'The uppermost bed of the lake-dwelling area consists, like that of the rest of the moor, of vegetable mould. For when the peat had reached to the surface of the water, its growth was checked, and by the decay of the marsh plants under the influence of atmospheric air, a bed of vegetable mould was formed called peat earth, which covers the surface of every peat moor.'

Plate VIII. is a careful sketch of one of Mr. Messikomer's excavations, showing the piles of the settlement of the middle age; they are all of round fir timber, and many of them have the bark still adhering to them. Plate IX. gives a view of the piles of the latest settlement, in an excavation a few yards

Section at the Lake Dwelling of Robenhausen, October 1864.

	Feet deep
½ foot—Mould	½
2 feet—Peat	2½
1 foot—No traces of fire—Stone Celts (Nephrite) - Pottery	3½
3 feet — Peat — Broken Stones — Flooring — Relics of the Third Settlement	
1 foot — Remains of Conflagration — Charcoal — Stone and Bone Implements — Pottery — Woven Cloth — Corn — Apples, &c.	7½
3 feet—Peat — Flooring — Relics of the Second Settlement—Excrements of Cows, Sheep, and Goats	10½
1 foot — Remains of Conflagration — Charcoal — Stone and Bone Implements — Pottery —Woven Cloth—Corn— Apples, &c.	11
4 or 5 inches — Relics of the First Settlement	12
Shell-marl	

FIG. 11.



I. Piles of earliest settlement, all round stems of soft wood (burnt).

II. Piles of second settlement (burnt).

III. Piles of latest settlement, made of split trunks of oak (not burnt).

distant from the first; they are of split oak-stems. Both sketches were taken on June 20, 1865.

It is a singular fact that the piles of all the three settlements incline from the north-west to the south-east, for which it is difficult to assign a cause. The piles of this settlement, like those of Niederwyl, are placed in straight lines, which run in the direction of the cardinal points.

A series of observations led to the conclusion that in the space of 150 feet long by 40 feet broad, where the canal ran through the settlement, there were six separate huts standing close to each other in order to economise room. For Mr. Messikomer at each of six different places, all at equal distances, found one of the well-known mealing stones previously described, heaps of corn, pieces of woven and platted cloth, stores of raw flax, together with the clay weights belonging to the loom, and also great stones which had formed the hearths. It is therefore evident that each hut was inhabited by one family, which had its own arrangements for preparing victuals and for making clothes. The length and breadth of the huts appear to have been about twenty-seven feet by twenty-two. And the construction of the timber floors is exactly the same both at Robenhausen and Niederwyl, although the substructure of the two is so very different.

The stalls for the cattle were distributed between the huts. Mr. Messikomer, who had formerly directed his attention while excavating chiefly to the discovery of implements and bones, has lately begun to investigate the nature and constituent parts of the peaty mud, and he has discovered in it horizontal bed from two to ten inches thick, varying in extent, composed entirely of the excrements of cows, pigs, sheep, and goats, together with the remains of the litter they had used. Some time ago a few of the fæces of goats had been found in a carbonised state, but they were taken for acorns or some other similar seeds. But a careful examination of them by Professor Heer soon revealed the true nature of these objects, so little pleasing in themselves, but so highly interesting when found in a lake dwelling.[1] With respect to the excrements of cows and swine, we must look for their determination not so much to the eye of the naturalist as to the practised glance of the agriculturist, and we may rely with implicit faith on Mr. Messikomer and his labourers when they assure us that this is the actual nature of these substances. The litter for the cows consisted chiefly of straw and rushes; that for the smaller animals was of sprigs of fir and twigs of brushwood. In these masses of excrement may be noticed the pupa-cases of the insects identical with those which are found so numerously at the present day in the manure of cattle-sheds.

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[1] With respect to the goats and their fæces, there cannot be the slightest possible doubt. Dr. Keller has kindly sent to me a small box of these 'Ziegenbohnen' (as they are very characteristically called in German), and I have exhibited them to one or two individuals, without giving the slightest hint as to what they were, and yet notwithstanding their carbonisation, their true nature was instantly discovered. In a late letter Dr. Keller mentions that from these deposits being found in regular beds amongst the remains of the settlement, it is the opinion of Professor Heer that they do not arise merely from the sweepings of the stalls, but that they were manure-heaps hoarded for agricultural purposes. Of late years a large quantity of these 'Ziegenbohnen' have been found in this settlement.—[Tr.]

Before we proceed to describe the more remarkable objects found here, it may be advisable to refer to a curious fact which has been observed by Mr. Messikomer, and which may probably throw some little light on the destruction of the settlement. As peat is now dug here more extensively than formerly, many places are worked at some distance from the bank. If we walk in a northerly direction from the locality of the lake dwelling, and examine the pieces of peat which have been dug here and laid to dry, we shall find that they all without exception contain more or less charcoal, while the peat on either side does not contain any. The strip thus marked by charcoal may probably be a few hundred paces wide, and its limits are clearly distinguished. It has before been mentioned that charcoal is very frequently met with in the settlement, indicating its destruction by fire, probably at repeated intervals; and Mr. Messikomer, with very great justice, from the presence of these pieces of charcoal in the above direction, concludes that one at least of these calamities took place at the time of the strong south wind so well known in Switzerland under the name of 'Fönwind,' by which the burnt materials would be driven along on the muddy surface in the direction mentioned, which is the exact course of this wind. If we bear in mind the nature of these settlements built of wood and straw, and so very liable to suffer from fire, and if we have ever personally witnessed the effect of the 'Fönwind' occurring at the time of a calamity of this nature, by which at one time or other nearly every town in central Switzerland has been almost destroyed, we cannot help concluding with Mr. Messikomer, that of the two earlier settlements of Robenhausen, one at least was destroyed by fire during the prevalence of this dreaded wind.

We will now describe the various objects found in the settlement. A few brief preliminary remarks, however, may not be out of place. The indigenous fauna is more largely represented here than in any other settlement: the bones are often found together in heaps of from fifty to one hundred pounds; from their weight some of them have sunk eight or ten inches into the mud at the bottom of the lake. As five tons of bones were gathered in the Aa brook canal alone, the mass of animal remains buried in the whole colony must be immense. Scales of fish are found everywhere in great abundance, a proof that fish formed a considerable portion of the food of the inhabitants; they also laid up stores of the water-chestnut (*Trapa natans*), and apples dried for winter use. In one place 800, or half a peck, were found together. Quantities of beech-nuts and acorns were also met with, which probably were intended as food for the swine. The whole weight of the pieces of bread found when the canal was deepened and altered, may be about eight pounds, and would probably correspond with newly baked bread weighing about forty pounds. Of stone-fruit there are more sloe than cherry stones. The seeds of raspberries, strawberries, elderberries, and blackberries, are also met with. The different varieties of corn will be especially described by Professor Heer. Mealing-stones and grinding-stones are common, and so are the hearthstones or those used for baking. Burnt rushes, the remains of thatch, are found in abundance, and fragments of pottery with various kinds of ornamentation are met with in countless numbers. The well-known tools of stone, horn, and bone, were very common.

OBJECTS OF WOOD.

Plate X. figs. 1, 2, 3. Knives of yew-wood. Fig. 2 is perfect. Figs 1 and 3 are imperfect. Fig. 1 has had two holes through the handle.

Plate X. figs. 4, 13, 17, Plate XI. fig. 9, and Plate XII. fig. 7. Dipping-vessels or ladles cut out of wood, some of which, considering the imperfect tools which the makers had at command, show astonishing skill in carving: they are very similar to those now in use in the Swiss milk-châlets. Plate XI. fig. 9, and XII. fig. 7, are of maple-wood: the fragment of a plate of maple-wood was also met with. Plate X. fig. 5 is a small object of wood cut almost in the shape of a little pulley.[1]

Figs. 6 and 15 are made out of bark.

Plate X. fig. 7. A club of ash-wood, in which is fixed a socket or hafting of stag's horn containing a stone celt.

Plate X. fig. 14. A similar club with a stone celt fixed in it, without any intermediate hafting. In both these cases, probably in order to hold the celt more firmly, and also to prevent the club from splitting when used, the head or upper part of the wood projects considerably beyond the plug-hole.

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[1] Can this have been a fishing-float?—[Tr.]

Plate X. fig. 16, shows another mode of fastening the stone celt. The club in this case is formed of the root of a hazel-bush; the celt is placed between two projections which are set at right angles or nearly so with the main root, and is fastened to them with cords.

Plate X. figs. 8, 8*a*, 8*b*. A boat (or 'Einbaum') made of a single trunk, twelve feet long, two and a half feet wide, and five inches deep. *a* and *b* show the longitudinal and cross sections.

Plate X. fig. 9. Flail for thrashing out corn; these implements are not uncommon either at Robenhausen or Wangen. When they were met with, the agricultural labourers of the neighbourhood at once pointed out what they had been used for.

Plate X. fig. 10. A yew bow measuring five feet round the curve, and notched at both ends for fastening on the string. A shorter and more perfect specimen, three and a half feet long, may have been a boy's weapon for the chase.

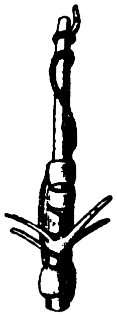
Plate X. figs. 11 and 12. These implements, which are not at all uncommon at Robenhausen, are of peculiar interest; at first they were considered as implements used for the churning or manufacturing of butter, but M. Rochat Maure, the engineer of Geneva, in the following notice, has clearly shown that they are to be considered as fishing implements:—

'The fishermen who at the present day use implements of this kind live, while the fish are going up, on the banks of the river Arve, well known for its cold and rushing stream. They pass the night almost like savages under huts made of twigs, and their small subsistence is extremely precarious; they catch the fish in the following manner:—To one end of a cord, the length of a stone's throw, they fasten a roundish flat stone, and to the other end a heavier stone of any convenient form. To this main cord they tie at intervals thinner strings with hooks at the end, and from three to five feet long. The heavy stone is then let down into the water from the boat at the side of the bank, but the other stone is thrown as far as possible straight across the stream towards the opposite bank. Early in the morning these cords are drawn up and examined, the implement used for this purpose being exactly like those found at Robenhausen. It is in fact the top of a young fir tree with the branches springing from the main stem like radii. A cord is fastened to the upper end of this kind of hook, and in order to make it sink, some leaden rings or hooks are fastened to the main stem: it goes by the name of 'Arpion' amongst the fishermen. It is thrown into the water from the boat, and when drawn up brings with it the thinner cords or those which have the hooks at the end. As the settlers at Robenhausen had no lead, it is possible that the perforated stones found in that settlement may have been used to sink these implements.'

The annexed woodcut (fig. 12) shows the form of the modern 'Arpion,' which is almost identical with those drawn (Plate X. figs. 11 and 12).

This implement is of great interest with respect to the history of civilisation, for it proves that implements which have actually derived their origin from the highest antiquity are at the present moment used in precisely the same manner.[1]

Fig. 12.



I have elsewhere called attention to the fact that the inhabitants of certain places in the Apennines now make their pottery in the very same way as did the inhabitants of the lake dwellings, and that the products of the two are not distinguishable, age only excepted; I shall presently have to call attention to other relics of a similar character.

Plate XI. figs. 1 and 2. Two celt-handles, for the most part well and carefully made; the first is of ash, the second of maple: they somewhat differ in shape from those previously mentioned, and are not very frequent in the western settlements, where stag's horn haftings prevail. The handle of fig. 2 is a root in which a kind of beak has been cut out for the insertion of a celt somewhat in the manner of Plate X. fig. 16. Many of the handles of the longer implements used for beating and cutting have a kind of head or knob at the end.

Plate XI. figs. 3, 4, and Plate XII. fig. 6. Wooden clubs; the first is of yew, and is pear-shaped; the last is also of yew, and has a cylindrical head with incised rings.

Plate XI. fig. 5. A float or support for nets made of the bark of the fir-tree. Implements of this kind are found of various sizes and in great abundance.

Plate XI. figs. 6 and 7. Suspension hooks. Fig. 7 is sixteen inches long. Objects of this nature of different sizes are found in great numbers; they belong to the internal furniture of the huts; no room appears to have been without them. They consist of a portion of the stem of a fir or pine tree cut off lengthwise, and having upon it a branch slanting upwards cut off at some little distance from the stem. They were doubtless fastened to the walls or sides by wooden pegs driven in through the incisions on each side, and used for hanging up implements and clothes.

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[1] My friend, Mr. G. W. Nicholl, of Ham Court, in Glamorganshire, who lived for many years at Usk—a place where old customs seem to linger with remarkable pertinacity—informs me that a similar implement was made use of within his memory in the river there, when swelled by floods from the hills; it was employed to secure any of the floating objects brought down by the stream.—[Tr.]

Plate XI. fig. 10. A great tub cut out of maple-wood.

Plate XII. fig. 3. An implement made of fir-wood, in shape like a chisel: it is imperfect.

Plate XII. fig. 10. Amongst the implements made of wood the most remarkable is a last, or rather a form or pattern, according to which the leather was cut for the coverings for the feet, the soles of the sandals with the straps belonging to them. This pattern resembles the modern lasts, but with this difference, that the bottom of the sole is flat, and not hollowed out to fit the foot like those of the present day. This implement, as the drawing shows, is imperfect, but the first glance will enable us to decide that it has been used for the above-mentioned purpose, and this is confirmed by the opinion of several shoemakers to whom it was submitted. The discovery of this last, which indicates an advanced stage in the art of clothing, is not at variance with our knowledge of other parts of the dress, as, for example, of the specimens of artistic cloth drawn, Plates CXXXVI. and CXXXVII., and more especially the fringe (fig. 7.) of the first-named plate, all of which betray a certain refinement of life and a tendency to luxury.

Plate XII. fig. 11. Knife or chisel of yew-wood.

Plate XIII. fig. 2. An implement of wood which is of interest, as it may indicate the connection between the stone and the bronze periods. It is only a fragment, and we are therefore unable to ascertain its use definitely. It may be conjectured that it was an ornament; but it is quite uncertain whether it was applied to the hut, to the canoe,[1] or to any household implement. It is of oak-wood, and is a portion split from rather a thick trunk. The outer side, which is arched, is worked smooth, while the inner side, which is flat, is sculptured into a series of projections and incisions, clearly showing that they have been made by the strokes of a hatchet of small power, doubtless of a stone celt. What makes this piece of wood of interest is the arrangement of the incisions, in which we recognise the earliest application of the zigzag or hatched ornament—a design which is so often repeated on the earthenware vessels of the stone and bronze age, but especially in such different modifications on the bronze implements of the latter period.

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[1] Its rounded extremity and flattened side might suggest the possibility of its being the blade of a short stout paddle as a friend has intimated to me.—[Tr.]

Plate XIII. fig. 4. A celt-handle, in which the stone was fixed into the wood without any intermediate hafting.

Plate XIII. fig. 5. A wooden implement somewhat in the form of a spoon, except that it is perfectly flat on the upper side; the sections to the left of the figure will show the form of the opposite or convex side.

Plate XIII. fig. 3. Yoke made of a hazel rod cut so as to carry a vessel.

Plate XIII. fig. 7. The top of a pile cut away in the middle for the support of the cross-timbers. Similar heads of piles are found at Niederwyl.

Plate CXLIX. Amongst the objects of wood found in this station, few are more interesting than the thin slab drawn on this Plate; it has evidently been a door, and so arranged as to turn upon a projecting portion or pivot on the left side. It is 4 feet 9 inches long, 2 feet 1½ inch wide, and nearly an inch and a half thick. Five holes may be seen in it; they may have been used for bolts as suggested in the 'probable adaptation' given at the side, or some of them may have been used for thongs instead of hinges.

Objects of Bast and Flax.—The interest attaching to the manufacture of these materials, whether platted, spun, or woven, is such that a special chapter is devoted to them towards the close of this volume; and it will therefore only be necessary here to state that numerous varieties of platted bast and of flax-yarn, thread, string, as well as platted and woven cloth, have been found at Robenhausen, and the reader is referred to the special chapter for any remarks respecting them. There are, however, one or two specimens which have been found very lately, and which, as they are not drawn in the plates appropriated to that chapter, will now be mentioned.

A piece of linen cloth was found here of the usual make, but it has a neat seam or border, which is extremely rare.

Plate XIV. figs. 2 and 6. Balls of string not in the least burnt. It is very singular that amongst the remains of conflagration and in the middle of worked and unworked flax which has been burnt, pieces of cloth and balls of wound yarn are not uncommonly met with which are quite uninjured, and yet when exposed to the air become so shrivelled and altered that their original form is hardly discernible. Fig. 6 shows the remains of a ball of string rather more than half unwound, which may be considered as what is called a warp or a ball of string wound ready for the weaver.

It ought to be mentioned here that though the proofs of the cultivation and manufacture of flax are manifest in no other lake dwelling to such an extent as at Robenhausen, yet in spite of the most careful examination of the relic beds, no spindle-whorl has yet been found here, while in some other settlements, where these implements are found in abundance, no traces of manufactured flax are met with.

Amongst the latest discoveries at Robenhausen is a piece of a mat or covering of some kind, made with a good deal of skill. It consists of several layers of a net-like plat, made of strips of bast from the willow or the lime-tree, bound together with flax-strips. Colonel Schwab thought that the whole material consisted of bast. The layers are not horizontal, but lie one over the other like tiles. This specimen is drawn fig. 6 of Plate CXL.

Objects of Horn and Bone.—Stag's horn is very generally used for the intermediate hafting of stone celts, between the celt itself and the wooden club forming the handle; one of these is drawn Plate X. fig. 7. Piercing and scraping tools, probably used in the ornamentation and shaping of pottery, as well as for various other purposes, such as arrow-heads and daggers, are found in great numbers made out of the bones of various animals and the ends of stags' horns.

Plate X. fig. 18 is a little implement, somewhat bent and notched at the smaller end, made of stag's horn.

Plate X. fig. 19. A flat implement of stag's horn used for knitting or netting. The notches on both edges, in fact the whole surface, have become polished by use.

Plate XII. figs. 2 and 9 are probably agricultural implements. Fig. 2 is the piece of a stag's horn ending in two antlers, and cut off from the main stem. This tool might be used either as a single or a double spiked hoe. Fig. 9 is a piece of stag's horn cut off square at one end and diagonally at the other; at the sloping end it has been hollowed out. It may have been used as a trowel for garden purposes.

An implement in the shape of a triangular shovel, with an attached spike, was also found, made of stag's horn, more than two inches broad at the edge, and about four inches long; its use is unknown.

The implements (Plate XIII. figs. 10 and 14) seem to have been scraping tools of some kind or other. Fig. 10 is simply a piece of stag's horn cut diagonally so as to form an edge, and fig. 14 is the shoulder-bone of some quadruped sharpened at one end into a shovel-shaped form.

Plate XIII. fig. 1, is a portion of a rib bound round with string, possibly part of a bow.

Fig. 3 of Plate CXXXIX. is the drawing of a pick or agricultural tool lately found, made of stag's horn.

Objects of Stone.—It is almost needless to say that stone celts were found here of the usual forms; they occur more or less plentifully in every station of the stone age. A very singular stone implement is drawn (Plate XII. figs. 4 and 5) in different views. It is a circular disc of tough stone like serpentine, with a round hole in the middle.

Plate XIII. fig. 13. A flint arrow-head particularly well made. Fig. 6 is a low cone or hemisphere of white marble, from Splügen, with two holes in it.

Under this head may probably be mentioned a small drinking-cup made of asphalt. This mineral is found at Val Travers (Canton of Neuchâtel), in Alsace, at Seyssell near the 'Perte du Rhône,' &c. It was used to make small vessels, for mending broken pottery, for fastening stone celts and flint arrow-heads into their handles and shafts, and also for the actual handles of pointed tools. (See Plate XIV. fig. 21.)

OBJECTS OF CLAY.

Plate XI. fig. 8 is an earthenware spoon.

Plate XII. fig. 8 is a small earthenware vessel well burnt, with two ears for suspension. Fragments of pottery in the shape of urns, plates, and cups are abundant.

Plate XIII. fig. 8 is an earthenware vessel with a handle; and fig. 9 is a similar vessel, but with two handles, and coloured black.

Fig. 11 is an earthenware cup of the most common form. In Colonel Schwab's collection there is a vessel half finished, proving that the pottery was made on the spot.

Fig. 12 is a cone made of clay mixed with charcoal-dust; it is perforated at the top, and was probably used as a weight for the loom.

Plate XIV. figs. 4 and 5. Borders or rims of earthenware vessels. Fig. 5 shows the commencement of the zigzag ornament.

Crucibles or Melting Pots.—Some years since an earthenware vessel of peculiar form was found which was then considered as a water-ladle; since then half a dozen similar vessels have been found, most of them very lately, and as they evidently have been exposed to a violent heat, we are enabled to decide on the true use of these specimens. All have at the edge a kind of drossy coating coloured like a deposit of copper, and in some places like the variegated copper ore. In three cases there were lumps of melted bronze, and in one instance a lump of pure unmelted copper. These vessels were consequently crucibles, in which small portions of this metal were melted down. They nearly all had handles by which they might be taken out of the fire. As no other trace of metal is found, or at least has yet been found, in the whole lake dwelling, there can be no doubt that we have here good evidence of the first attempt to work this material, and that we are on the borderland between the civilisation of the stone and the bronze ages; it is very evident also that this attempt has been made by no ignorant hand, but by someone well versed in this kind of work. The material of the crucibles is clay mixed with horse-dung, a combination which is now used for moulds in which brass is cast.

Plate XIV. figs. 14 to 20 (of which some are drawn in section) will give a general idea of these implements; and Plate XXI. fig. 14 is a sketch on a larger scale (half the full size) of the crucible containing portions of metal still remaining: the places where these portions still adhere are marked with a red tint.

It would be a matter of no small interest to ascertain how the colonists got their copper, for, according to the views of different antiquaries, it was not brought into central Europe either from the north or the south in a pure state, but mixed with tin in the shape of bronze. Although the discussion of the difficult question as to the origin of bronze in general, and the mode in which it spread over central Europe, may not seem to belong to the present account, yet I cannot help making the following remarks, which bear on copper found in the crucibles. As we see that the colonists in the stone age undoubtedly possessed various substances which they obtained from a distance by exchange, such as amber, glass beads, nephrite, and various kinds of flint, we may be certain on the other hand that these same people thoroughly examined the valleys and mountains of their country, in search of any objects which might be useful to them. Thus we find amongst the materials used for different purposes red flint, probably from Bavaria or the Vorarlberg, micaceous schist from Davoz, Scaletta, and Fluela in the Grisons, red sandstone, now used for whetstones, from Rheinfelden (Aargau), crystals from the High Alps, asphalt from the Val Travers (Neuchâtel), white marble from the Splügen, &c. May we not venture to assume that the colonists, by their intercourse with strangers who were acquainted with the nature of metals, were incited to search their country for copper ore and to try to melt it and cast it? Copper ore (Kupfergrün)[1] is found on the south side of the Mürtschenstock on the lake of Wallenstadt; and it is known that both in ancient times and even within the last ten years mining was in operation there, and four of the old pits are still known. Slag from the melted copper ore is still to be seen in the Mürtschenalp. The variegated copper ore was mined both in ancient and modern times at the Daspinerhorn, near Andeer, in the Grisons, and grey copper ore, which was also used in ancient times, is found at Obersaxen, near Ilanz, in the Grisons. It can hardly be doubted that when once the nature of copper and its fitness for tools became known, it would be everywhere sought for. The author Posidonius, who calls the Helvetians 'rich in gold,' shows how assiduously in early ages they washed gold out of the sand of their rivers.

Before concluding this account of Robenhausen, one of the most interesting of all the lake dwellings yet discovered, it may be well to recapitulate the main results of the latest investigations of the locality.

1. The founders of the settlement were perfectly acquainted not only with the cultivation of wheat, but also with that of flax, and they knew also how to manufacture this last material —by spinning, platting, and weaving—into thread, string, rope, nets, and cloth of various descriptions. Even at Moosseedorf, where till lately there has been a doubt as to any traces of the cultivation of flax, Dr. Uhlmann has recently met with linseed, and thus proved that the settlers there were acquainted with

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[1] 'It is said that the mine at the Mürtschenstock, 5,284 feet above the level of the sea, was worked by people from Basle, in the place called Feldried, and was given up in the fourteenth century at the time of the "black death." Some inconsiderable hollows at the head of the load seem to confirm this tradition, as also the remains of walls and slag in the Feldried. In any case the mine must have been an ancient one, for in these old holes there are no traces of blasting.'—Stöhr.

the cultivation of this plant. In fact, it seems as if the conclusions arrived at respecting Robenhausen will also apply to all the stations of the stone age.

2. The nephrite, which according to the latest investigations is to be considered as a foreign material, not found in the district of the Alps,[1] was not brought by the settlers with them from their earlier abodes, but was acquired by barter in later times, after they had lived for centuries in the lake dwellings of our country.[2]

3. The settlers, as has been supposed before, were in early times acquainted with copper and bronze, for traces of the working of these materials have been met with in the lower beds of the stone age settlements, before the appearance of nephrite.

4. If we compare the implements of the three relic-beds, there is no evidence of any important difference or of any striking improvement either in material or form. The products of the potter's art remain nearly the same as to workmanship,

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[1] Professor von Fellenberg has done valuable service to the cause of science by a careful analysis of the nephrite found in the Swiss lake dwellings, both by deciding the true nature of this stone, and also by bringing the question to a point—whether this nephrite is a native production, or a foreign mineral probably brought out of the east. In an interesting paper, 'Analysen einiger Nephrite aus den schweizerischen Pfahlbauten, Bern, 1865,' he sums up his views on the origin of this stone in the following proposition:—'We may with great probability affirm, so far as component parts are to be relied on to prove the identity or non-identity of two uncrystallised minerals, that the stone celts of Meilen and Concise are of genuine nephrite (whether of the New Zealand kind or not is doubtful), but that that from Moosseedorf is of jade (vert oriental). One question yet to be decided is, whether the nephrite found in our lake dwellings may not also have been of Swiss origin, like the celts more commonly found with it, made of serpentine and siliceous schist, for the serpentine and chloritic schist mountains which occur in the New Zealand nephrite districts are found also in Switzerland, widely spread to a considerable extent, as in the Grisons and the Valais; and very possibly also may show segregations of nephrite. Still it has never yet been found here, so that the supposition of its eastern origin, as far as the proofs have hitherto gone, may perhaps be considered the more correct and probable.'

This view of Professor von Fellenberg, that nephrite is a foreign mineral, is borne out by the facts that hitherto no Swiss geologist has found it either *in situ*, or in the shape of gravel; and that no unworked pieces, nor any waste or chippings from it, have yet been found in the lake dwellings.

[2] My friend, the Rev. C. W. King, who has made the ancient precious stones his peculiar study, in a late letter has sent me the following extract from Anselm de Boot, Gemm. et Lapid. Hist. ii. 109:—'Lapis nephriticus . . . adfertur ex Nova Hispania. In nonnullis etiam Hispaniæ locis et in Bohemia reperitur, sed paucis adhuc notus est, quia a lapidariis imperitis pro smaragdo, prasio, vel pro iaspide habetur.' Mr. King remarks that De Boot's opinion upon the point is to be relied on, for he describes the stone minutely and accurately from several specimens in his own possession, and proceeds to relate numerous proofs of its curative powers within his own medical experience.—[Tr.]

shape, and ornamentation. The assertion that the perforated celts belong to the end of the stone period has not been proved. It is only in the relic-bed of the third settlement, where the nephrite first appears, that greater dexterity is to be remarked in the mode of working flints. From all this it may be assumed that the civilisation of the colonists underwent no material change during the many centuries of the stone age.

5. The cattle, their stalls and winter stores, were not kept on land as was formerly supposed, but on the lake dwellings themselves. (Compare the passage in Herodotus v. 16.) Although this statement is based only on the observations made at Robenhausen, there cannot be the slightest doubt that the manner of life was the same in the different lake dwellings, and that what is said of these settlements will also apply to all the others; nor can we hesitate to believe that discoveries will shortly be made at Wauwyl, Niederwyl, and other settlements buried in peat, which will confirm this opinion. With respect to those stations, the remains of which are found in the lakes themselves, no similar result is to be expected. This fact to a considerable extent confirms and establishes our views as to the mode of life amongst the inhabitants. We may now consider the lake dwellings as insular settlements or fortresses occupied not only by the inhabitants with their household property, but also by their herds, with the stores of fodder and the sheds required for their accommodation.

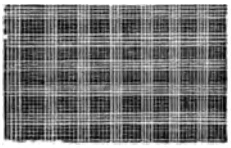
Several places in the lake of Pfäffikon were formerly considered as the sites of lake dwellings on account of a few piles and some antiquities having been found in them, but later investigations have shown this to be more than doubtful. This remark applies to Pfäffikon, to Riedbühl, and to Himmerich. In the latter place there is a singular bank or dam a few paces from the shore, fifteen feet broad and about 600 feet long, as shown (Plate VI. fig. 5). Mr. Messikomer has dug through this bank in several places, and found Roman tiles and pottery.

One other locality, however, on this lake was undoubtedly a settlement of very considerable interest, as the arrangement of it was peculiar, and some of the antiquities found in it are quite unknown in any other lake dwelling. The settlement of Irgenhausen was situated about 200 feet from land, near a hill crowned with the ruins of a Roman castrum. The lake dwelling ran parallel with the shore, was about 300 feet long, and thirty feet broad; when the lake was at its average level, it was covered by about nine feet of water. Apparently it consisted of a single row of huts; for there are heaps of stones at nearly equal distances apart, on each of which there was a mealing apparatus—both the nether stone and the corn-crusher together, as if they had sunk into the water when the settlement was burnt. Probably there have been altogether from eight to ten huts. The antiquities hithèrto found here are corn of different kinds, such as wheat, barley, millet in the shape of bread, also woven cloth, and lastly, what has never yet been found before, and what could hardly have been expected, the remains of actual embroidery.

These specimens consist of the simple well-known cloth of the lake dwellings (such as that drawn Plate CXXXVI. fig. 8), on which various designs have been formed by means of a needle and thread. Only about half-a-dozen specimens have been found of this embroidered cloth, and they were sewn together with thread, and appear to have been cut off from a larger piece. A drawing of a part of this cloth is given, Plate CXXXIX. Fig. 2 represents this portion with its constantly recurring pattern, one-third of the natural size. Figs. 2, *a*, *b*, *g*, show the different patterns of ornamented cloth, and fig. 2, *g*, is a piece of the plain cloth used for the 'groundwork,' drawn of the natural size.

A kind of cloth has also lately been found here which appears to be new, and is almost a coarse pattern of what drapers call 'checked muslin.' It has been made simply by an alternation in both directions of rows of five or six fine threads, with rows of probably the same number of stronger ones, almost amounting in thickness to small string. See the subjoined woodcut, fig. 13.

Fig. 13.



WANGEN.

It has now been ascertained that nearly every part of the shore of the Untersee was studded with lake dwellings. All of those which are known will be mentioned in the geographical list; but there are some settlements which have been so carefully examined that they deserve an especial notice, and none more so than Wangen, which has been so well investigated by Mr. Caspar Löhle; it is, in fact, to him that we are indebted for the greater part of what we know as to this locality.

When the first account was published of the discovery at Meilen, Mr. Löhle remembered having seen similar objects near his house, and first began to collect the antiquities found on the shore in the autumn of 1856, and also during the winter, when the depth of the water was favourable. He subsequently began to excavate, and laid bare a considerable portion of the area occupied by the lake dwelling, when he was rewarded by the discovery of several things not previously known, such as ears of barley, and woven linen cloth, besides an extraordinary number of stone and bone instruments.

The lake dwelling of Wangen lies east of the village, in a bay which is sheltered from the violence of the west wind by a point of land called the 'Wangenerhorn,' in a place called 'im Gau.' A fruitful tract of land extends from the bank of the lake to the sunny slopes of the neighbouring hills. The piles run along the shore, now partially encroaching upon it, and form a parallelogram of more than 700 paces long and 120 paces broad. In some places the bottom is gravelly, in others it is covered with mud. On the side of the lake the piles are about three feet deep in the ground, on the side of the shore they are six or seven feet; for in the course of centuries a mass of organic matter has been deposited here, and also a very considerable quantity of gravel and sand has been washed down by the action of the waves, so that the original lake bottom is now covered by a bed about three feet deep. From the circumstance that the piles farthest from the shore can, in winter, be reached dryshod when the water is at its lowest level, it seems to follow, as there has been an accumulation of two or three feet of alluvium, that during the last 3,000 years there has been no decided change in the level of the lake. It is hardly to be supposed that the dwelling, in its original state, stood part of the year in the water and part on dry land.

The piles consist of the different kinds of wood growing in the neighbourhood—viz., oak, beech, elm, birch, fir, ash, elder, maple, and two kinds of willow. They are either whole stems, or they are trunks split into two or three parts; and they have been sharpened in some cases by fire, and in others with stone celts.

They were driven in for the most part one or more feet apart, so that in the space of a square rod there are at least twelve, though sometimes seventeen or twenty-one may be seen. In some places, however, where a firmer support was necessary, three or four piles are found driven in close together. The whole number of piles, forming the substructure of this settlement, is estimated by Mr. Löhle at from 40,000 to 50,000.

Of all the dwellings of the olden time yet examined, none has afforded such an abundance of implements as Wangen; they were found in the 'relic bed' about two feet below the surface; and as many of them are particularly remarkable, it will be well to describe some of the most interesting.

Stone Celts.—These tools have been found to the number of many hundreds, of different sizes and shapes, and in every stage of manufacture, a convincing proof that they were made in this very locality. The rolled stones of the neighbourhood, originally derived from the Rhætian Alps, formed the material for the greater portion. Only a very few specimens were made out of an inferior kind of nephrite. It is, however, remarkable that the majority of the celts, hammers, and other implements found here were of decidedly inferior workmanship, and were quite common tools, just made for the necessities of the case; they are not at all to be compared with the corresponding implements found at Mänedorf, Meilen, &c.

Cylindrical hammers of serpentine, with a haft-hole, and, in general, perforated stone tools of any kind, are the greatest rarities; on the other hand, stone hammers of a cubical form, with the edges rounded, made out of hard sandstone, are uncommonly numerous. Cutting tools made out of yellowish black and red flint, such as saws hafted in wood, and fastened with asphalt, arrow and lance heads, are found in tolerable abundance. As this kind of flint is chiefly found in the neighbouring parts of

France, we may consider these implements, or the material out of which they were made, to have been articles of barter.

Pointed tools, little chisels, arrow-heads, &c., made of the bones of stags, roes, and other small or large animals, and even of birds, have been found in extraordinary numbers and of all shapes; and the same remark will apply to the larger pointed tools, to the great awls or piercers, the daggers and the lance-points, made out of the horns of stags and roes. Some of the bone arrow-heads have the asphalt still remaining which helped to fasten them to the shaft. A piece of stag's horn, blunt at one end and running to an edge at the other, exactly like that drawn Plate XIII. fig. 10, with a hole through it in which a handle is firmly wedged by splinters of bone, was considered, both by Mr. Rey and also by Mr. Löhle, as a tool used for horticulture.

The earthenware vessels are not different, either in form or material, from those found at Meilen, Robenhausen, and Moosseedorf. Even the ornaments, consisting of impressions and bosses are exactly the same. It may be remarked, however, that most of the vessels are of the most simple shape, approaching that of a cylinder, and that many of them are coated either inside or out with a thick covering of soot.

Spindle-whorls of clay are found in abundance.

Perforated balls of clay, mixed with a large quantity of charcoal-powder, like the material of the conical objects found at Robenhausen, are also met with by dozens.

Slabs of sandstone with lines or furrows made by grinding the stone celts upon them, and also others which have been used as hearth-places, are very abundant.

Amongst the objects of peculiar interest may be mentioned the large quantity of corn which had been dug up in many parts of the area of the lake dwelling, both in whole ears and in separate grains, but always in a burnt state: the two-rowed barley (*Hordeum distichum*) and wheat, both of excellent quality, may be easily recognised. Of wheat there are two varieties, the common wheat and the two-rowed corn, or what is called summer corn. In one place where there was doubtless a store, more than a bushel was found. The fruits of the wild apple and of the wild pear were also met with turned to charcoal in a similar way. In some places there were large quantities of the husks of pine-cones, beech-nuts and hazel-nuts, the seeds of crabs and wild pears, with the small stalks of these fruits, and the seeds of raspberries and brambleberries: these evidently were the refuse of the colonists' feasts.

In the course of several excavations which have been made by Mr. Löhle, he believes that altogether he has obtained nearly one hundred bushels of corn of various kinds, so that there can be no doubt that the colonists carried on agriculture to a considerable extent. It is also a matter of peculiar interest to find that in one of his later excavations, Mr. Löhle has discovered actual baked bread or cake, made of the crushed corn, precisely similar to that found about the same time by Mr. Messikomer at Robenhausen. Of course it has been burnt or charred, and thus these interesting specimens have been preserved to the present day. The form of these cakes is somewhat round, and about an inch or an inch and a half high—one small specimen, nearly perfect, is about four or five inches in diameter. The dough did not consist of meal, but of grains of corn, more or less crushed. In some specimens the halves of grains of barley are plainly discernible. The under side of these cakes is sometimes flat, sometimes concave, and there appears no doubt that the mass of dough was baked by being laid on hot stones, and covered over with glowing ashes.

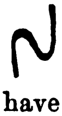
Some other burnt masses, which have been considered as the remains of vegetable food, appear really to consist of leaves.

It was not entirely for the production of corn that the ground was cultivated; the growth and manufacture of flax evidently occupied no small share of the attention of the colonists: it is found in all stages, from the unworked stems with the capsules still adhering to them, and in perfect preservation, to the most beautiful specimens of platted or woven cloth.

In the same bed of mud which contained the remains of piles and household implements, there were found, as in other lake dwellings, quantities of moss, rushes, bark of trees, wisps of straw, and small twigs, part of which probably formed the roofs of the huts, and part may have served as the bedding of the inhabitants.

It may be well here to mention, that besides the different kinds of wood used for piles, as before stated, some others were found at Wangen, such as the hazel, the apple, and the pear-tree. The stems of the two last were not used for piles, but for hewing blocks on which the colonists worked; they were found lying down, and partially burnt: they are about a foot and a half in diameter, and two or three feet long. Fir-wood and the kinds allied to it are rare, doubtless because it was not to be got conveniently; for the pine forests are on the mountain heights, at some distance from the shore. Only some small traces of yew-wood were discovered here. There is some little doubt as to the cherry-tree, the actual stems have not yet been met with.

Amongst the few bones which have been found at Wangen, Dr. Rengli has recognised those of the urus (*Bos primigenius*, Owen), and the aurochs (*Bison priscus*, Owen),[1] the stag, the roebuck, the wild boar, the wolf, the fox, and the dog.

In one of Mr. Löhle's later excavations he made the singular discovery that some of the piles are twisted up in an extraordinary manner; that is, they had been pushed out of their upright position and bent or pressed together thus,  ; so it is clear that the weight of the superstructure must have been very considerable. In these cases several strong piles had been placed underneath, to increase the strength of the substructure, to shore up the platform, and to prevent it from sinking further and going to ruin.

Mr. Löhle has also mentioned another peculiarity respecting this settlement: the antiquities are by no means evenly spread over the whole of its area, but there are certain places where they are found in greater abundance than in others; and there are also places which have proved entirely barren, even after a very careful search. Thus the burnt or charred flax is only found in certain localities tolerably well defined, and from four to six square rods in extent; but it is in all stages of manufacture, in stems with the seed vessels still remaining, in bundles, or what are technically called 'heads,' very well put together, spun into threads, or made into neat and artistic plat with bands of willow-bark or withy-peel. Mr. Löhle is quite right in supposing that these places must have been the spinning-rooms of the colonists, or their store-rooms for flax in its different stages. In the same manner there are localities where straw and straw-plat are plentiful.

There are also certain other peculiarities respecting the antiquities found at Wangen which are worthy of notice. Notwithstanding the very large area which has been examined, and the great quantity of stone implements which have come to light, only one single case has occurred of the celt having been hafted in stag's horn, like those which are found abundantly in nearly all the older lake dwellings. The mode in which the stone celts were here almost exclusively hafted, was by means of a double or forked branch of a tree, one portion of which, intended to receive the celt, was cut off some inches above the joint or point of junction, and then split; the other was left long, so as to be used as a handle. As in the case of similar implements made by the aborigines of North America, it was quite necessary in order to fasten the celt or hatchet, to have the two parts of the split branch bound round tightly by strings of bast or vegetable fibre, flax-cords, or thongs of leather. From the length of the handle, Mr. Löhle concludes that these tools were used sometimes with one hand, and sometimes with two. The kinds of wood used for this hafting or handle were chiefly the hazel and the willow.

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[1] These two animals do not stand in Professor Rütimeyer's list from Wangen.—[Tr.]

One or two more peculiarities of the settlement of Wangen may also be mentioned: the perforated balls of clay, mixed with charcoal, seem to be found in no other station; while the black perforated cones of similar material, so abundant at Robenhausen, are not met with here. The clay rings also, so common in the western lakes, and the roundish stones with furrows, or what are called sling-stones, are not found in the east.

On the whole, this settlement appears to belong purely to the stone age, and this is the more remarkable as the inhabitants evidently were pre-eminent both as agriculturists and as handicraftsmen. They produced many sorts of beautiful corn and flax, and they manufactured several descriptions of both platted and woven cloth. All these productions, the result apparently of a settled mode of life, and of peaceful industry, stand in striking contrast with the wretched implements and tools made of bone, stone, and wood; and we cannot wonder at the question arising, whether we are to look upon these colonists as in the full possession of their acquired civilisation, or whether, by long wandering and moving from one inhospitable region to another, they had degenerated, and having sunk into a kind of barbarism, had fallen back upon hunting and fishing, and carried on agriculture, once their chief support, only as a remembrance of their former better condition.

A few of the antiquities found at Wangen have now to be enumerated. Amongst the more interesting objects are the manufactures of flax; but as these will all be described in the chapter specially devoted to this department of the industry of the lake-dwellers, it will be sufficient here merely to refer to them. Probably that drawn in the upper part of Plate

CXXXVIII. is the most curious; it looks like the top of a cap, platted out of flax. Several of the specimens also in Plates CXXXIV., CXXXV., and CXXXVI. were found at Wangen, and will, as already stated, be described in a subsequent chapter.

The spindle-whorls drawn Plate XXI. figs. 11 and 12 are connected with the manufacture of flax, and may therefore be appropriately mentioned here: they are of clay; one is ornamented with lines and the other with dots.[1] Figs. 7 and 8 are perforated balls of clay, mixed with charcoal-dust; these balls were formerly considered as fire-balls, used by an enemy, when heated, to set the lake dwellings on fire—an opinion which appears to me very fanciful. Fig. 9 is a club made out of the branch of a tree with a wen-like appendage, which had been cut into a round form. Several implements of this kind have been found at Wangen.

Fig. 10. Flint saw set in the small tine of a stag's horn.

Fig. 13 represents a portion of burnt straw, the stalks lying close together as if they had been used for thatch.

Fig. 6. Vessel of earthenware made of grey clay, mixed with little stones and with incised ornaments, doubtless the best-made specimen of pottery found at Wangen.[2] In the pottery

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[1] In the 'Palafittes' of Professor Desor, it is stated, page 68, that stone spindle-whorls are characteristic of the stone age, and clay spindle-whorls of the bronze period. This proposition is not universally valid, as the above notice in the text will show. Clay spindle-whorls are found in many other settlements of the stone age besides Wangen.

[2] In Sir John Lubbock's work on 'Prehistoric Times,' page 136, some doubt has been thrown on the accuracy of this drawing, apparently judging merely from a cast. It seems to me that in the case of rough specimens, like the one under consideration, a cast is rather doubtful evidence on which to rely, and I therefore, when at Zürich last summer, brought the matter before Dr. Keller. He informed me that formerly the portions from which the drawing was 'restored' were much larger than at present; but by some means or other parts were broken off, and he immediately produced the remaining pieces. From what he remembers of the original fragments, he is quite convinced that the 'restored' drawing gives a fair idea of the original, and he requested me to reproduce it. I have also given on Plate XV. drawings of the pieces *as they now are*, for the accuracy of which I can vouch, and which, to a considerable extent, bear out the correctness of Dr. Keller's original figure. In the present edition this plate has been redrawn, and, I believe, with still greater accuracy than before. Individually I prefer that antiquities should be drawn in their present state and not 'restored'; but the custom of foreign antiquaries is quite the reverse, and when there can be no doubt as to the form, &c., they consider that 'restoration' is necessary to do justice to the subject. Dr. Keller informs me that he has been blamed by German antiquaries for drawing several antiquities as they now are, and not representing them restored, or in their original state.

May I add that even if the markings on this vase were intended for leaves, *which was never stated in the description by Dr. Keller*, I do not see very clearly why they should have excited the surprise of Sir John Lubbock? Some implements of the reindeer age from Bruniquel, lately placed in the British Museum, exhibit very excellent out-found at Ebersberg, and in most of that from the tumuli of East Switzerland, which have incised line ornaments upon them, the lines are filled with chalk, which is set off more distinctly by the red or black colour of the ground.

Plate XIV. figs. 10 and 11 are two views of a flint arrow-head regularly serrated. Arrow-heads of this description, as well as those which are barbed, and, in fact, flint implements of any kind elaborately worked, though they abound in the north, are rarities in our district, where the raw material is scarce, and consequently the manufacture never came to any great perfection.

Fig. 13. Small bone implements made of the tarsal bones of dogs, sometimes found together by dozens in the lake dwellings; some are perforated at one end. They appear to have been amulets or personal ornaments.

Fig. 8. Portion of an implement furrowed and rather curved, made out of stag's horn.

Figs. 23 and 24. Fishing implements made of bone. These occur very abundantly. A straight pin or shank is cut away a little, or has an incision round it in the middle to which the fishing-line is attached, and then the little pin is quite covered over with the bait; when swallowed it cannot easily be got rid of by the fish. This plan is now in use on the Untersee for catching ducks.

Plate XXII. fig. 6. A fishing implement made of the branch of a shrub and its offshoot, and intended for drawing together and arranging the nets when dried. Exactly similar implements are now in use amongst fishermen.

Plate XIV. fig. 1. A piercing tool of bone, perforated.

Fig. 3. Sectorial molar of wolf, perforated in the fang, no doubt intended to be worn as an amulet.

Fig. 7. Small ordinary rounded stones, simply perforated. Stones like these are very abundant in the settlements of the lake of Constance, and also at Robenhausen.

Fig. 9. Ornament on a fragment of a roughly made urn-shaped earthenware vessel. See also Plate XV. fig. 1.

Plate CXXXIX. fig. 1. A peculiar ornament on pottery which is not rare at Wangen; it consists of a series of points or dots arranged in the form of a crescent. It occurs on similar vessels to those with the coarse kind of ornamentation

lines of animals' heads, which unquestionably are better executed than the rude markings on the Wangen pottery, and yet they must in all probability be of much earlier date.—[TR.]

drawn (Plate XIV. fig. 9, and Plate XV. fig. 1), and appears like it to represent the half-moon.

Mr. Löhle has lately found a board of oak-wood, between seven and eight feet long, and a foot and a half broad, with a corner rounded off on one side—apparently a bench to form a seat; and this view of it is rendered more probable by the fact that on one side (the upper one) it has been smoothed by being sat upon, and that it is the outer edge or corner that would correspond with this smoothed part, which has been rounded off. He has also found a round board of oak two and a half feet in diameter and about two and a half inches thick, with a hole running diagonally between the centre and the circumference. It has been taken for a shield, but this idea is probably inadmissible.

Some small celts of jadeite[1] have also been found, which is a kind of stone of a greenish colour, surpassing even the genuine nephrite in hardness, as it cannot be scratched by the hardest English file. This is the very hardest stone, which was ground down by the lake-dwellers, for the flint and rock crystal were brought to the required form by blows from a hammer.

A fact which may throw some light on the food of the colonists is that Mr. Löhle finds in several places at Wangen beds of a brownish material, an inch thick and several feet wide, chiefly composed of apple-cores. The fact of such a quantity of remains of the apple being found together shows that the harsh wild crab was then as commonly eaten as the cultivated fruit is at present with us. Part of the brown substance arises from the undigested rinds of apples, and may indicate that the colonists were accustomed to make 'must,' or beverages, from different kinds of fruit.

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[1] See the note by Professor von Fellenberg on the analysis of nephrite, towards the close of the account of Robenhausen, page 61. See also the excellent work 'Nephrit und Jadeit,' by Professor H. Fischer. Stuttgart, 1875.

THE FASCINE STRUCTURE OF NIEDERWYL, NEAR FRAUENFELD.

THIS settlement, together with that of Wauwyl and a few others not yet thoroughly examined, show us that we may divide the lake dwellings into two classes; viz., what may be called pile dwellings, or those of the usual form, consisting of upright piles driven into the bed of the lake, and supporting a horizontal platform on which the huts were erected; and what may be called fascine structures (Faschinenbauten, Packwerkbauten, fascinage). In the dwellings of this kind the substructure does not consist of piles, but a mass of fagots laid parallel and crosswise one upon another, the lowest bed of which rests on the lake bottom. A layer of brushwood or of clay and gravel is spread between each of the beds of wooden material. The upright piles found in this mass of wood were not intended to support the superstructure, but to keep together the individual parts of the substructure; some of them also helped to form the walls of the huts and to support the roof. As at Wauwyl, they served chiefly as stays to prevent the structure from bulging horizontally. The fascine dwellings seem only to have been adopted in lakes of small depth and extent, and chiefly owe their origin to the fact that piles driven into the boggy beds of lakes of this kind would not have been able to bear the necessary weight: if heavily laden, they would have sunk down below the level of the water, or they would not have retained their proper position. It was impossible to adopt the fascine structure in the larger lakes; for it must have been foreseen that the waves, which could drive amongst the upright piles of the usual pile dwellings without injuring them, would in stormy weather wash over the edges of the fascine platform and tear it in pieces.

It is clear that the fascine dwellings were much more simple, and more easily erected than the pile dwellings, as they did not require any artificial means of joining the wood together. The commencement of the work seems to have offered the greatest difficulty.

For we find that there is a regular succession of different layers of fagot-sticks, brushwood, and gravel, down to the bottom of the lake to a depth of twelve or fourteen feet, just as if the structure had been made on dry ground; and the question naturally arises, how it was possible under water thus to arrange these masses of wood so as to lie quite close and to lock into each other. The only conceivable mode of explaining it seems to be this: at the commencement of the work several piles were driven into the mud from a raft, from twelve to twenty feet apart, and then fagot-sticks were piled up between them horizontally one upon another, just as we find them arranged in the excavation; when loaded with a sufficient quantity of gravel, the whole mass of fascines must necessarily have sunk down to the bottom between the upright piles which served as guides or stays. In this manner a number of masses of wood were laid in the water one after another till the substructure had attained the desired height. Naturally the part above the water was more carefully executed. The upper beds of fascines in fact lock into one another at the ends, and form one continuous mass; and no large vertical gaps or chinks filled with clay, gravel, branches, or brushwood, are to be found here, like those which are very common when the lower part is exposed. This fact seems to confirm the above idea of the mode of construction.

It may be asked whether this fascine or fagot-work mode of structure indicates a higher antiquity on account of the greater simplicity of the substructure, and whether it may be considered as the original mode of erecting a habitation. But the manner in which some of the timbers belonging to the superstructure were worked and joined together by mortises and tenons, as well as the products of the potter's and other industrial arts, and more especially the successful prosecution of agriculture, which is here very evident, sufficiently prove that the degree of civilisation at the time of the fascine dwellings perfectly agrees with that of the other settlements of the stone period at Moosseedorf, Robenhausen, Wangen, &c.

Niederwyl differs from the allied structure of Wauwyl by the arrangement of the layers of wood above the water being very much more symmetrical, and also by the general use of split stems, and of actual boards two feet broad and two or three inches thick, the making of which must have been attended with much labour.

Niederwyl has thrown some new light on the nature of the huts. The floor of them consisted of layers of fagot-sticks or thin unpeeled stems two feet long, laid parallel to each other, the spaces between being carefully filled up with clay and rushes. The interior was enclosed with boards standing on their edge, and forced in between the upright posts forming the supports of the walls. As in all lake dwellings, the space between the posts, three or four feet wide, was filled in with wattle-work and then coated with clay. The roof was formed of layers of straw and rushes. The dwellings, which were rectangular, stood tolerably regularly alongside of one another, and the space between them was two feet, or at the most three feet. On the average they were twenty feet long and twelve feet broad. In the corner of one of them were found plates of sandstone used as hearthstones, which were covered with a heap of charcoal and ashes.

The layers of branches, gravel, ashes, and clay, between the beds of fagot-sticks, served to fill up the chinks or spaces, but not to keep the damp from the rooms above, for such masses of slender materials lying one above the other would have drawn the water upwards as by a sponge.

The abundance of corn (wheat and barley) and of animal remains shows that the inhabitants of this settlement lived chiefly by agriculture and keeping cattle, and that they carried on both to a considerable extent. As that part of the swampy lake left unoccupied by the dwelling itself was apparently not fed by any regular stream, but depended chiefly on rainwater, and perhaps some insignificant springs, fishing there could only have afforded the inhabitants a very small amount of sustenance, as the fish would be small and of inferior quality.

The use of flax was quite as general at Niederwyl as at Robenhausen. Several peculiar patterns of platted and woven work show the skill of the colonists in working this material; and if we may venture to judge from the number of fragments of both thick and thin cloth found in all parts of the dwelling, it seems reasonable to conclude that the inhabitants were not clothed in skins but in linen garments.

Another fact has been proved by the excavation, which is by no means unimportant:—No trace of burning is to be found in this settlement, so that it evidently was not destroyed by fire, but was voluntarily abandoned.[1]

It seems probable that the dwelling of Niederwyl existed for some centuries, and that originally it was smaller and had not either its present height or extent. This supposition is confirmed by the following facts: hatchets and woven cloth were found in the lower beds; the stems of wood often lay quite sloping, so that in repairing the upper platform an even surface would have to be adjusted by means of heaps of gravel: some masses of the wood were observed to be comparatively more recent; and burnt or charred places, marking the sites of former hearths, were met with in the beds lying under water; all of which clearly indicate a gradual depression of the whole mass of wood, and the repairing of it by additions to the upper platforms.

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[1] The settlement might possibly have been starved out, and so surrendered.—[Tr.]

It will readily be perceived that the fascine dwellings resemble in many respects both the Gallic fortifications described by Cæsar and also the Irish crannoges.

After these general remarks, it may be well now to give an account of the discovery of this singular settlement and of the excavations which have taken place.

Between the ancient Roman military road from Vitudurum (Winterthur) to Ad Fines (Pfyn) and the post road from Winterthur to Frauenfeld, there is an open place surrounded by low banks, in which is a small marsh or bog-lake, formerly called Egelsee, the extent of which is about sixty acres: the greater part of it, in the course of centuries, has changed into a peat moor. It was formerly used as pasture land, but of late years it has been dug for peat; and as this operation was hindered by the water coming in from the rest of the marsh, the proprietors of the estate determined on cutting through the bank of earth which bounds the moor on the south side, and making a sluice, which, while it allowed the water to run from the peat diggings, might be dammed up in future to allow the new formation of this material.

There is one place in this moor where the workmen, at a depth of two or three feet, came upon a bed of clay, mixed with wood and all kinds of chips and rubbish, containing little or no combustible or peaty matter. It is about 100 feet distant from the eastern bank of the ancient lake, 300 feet from that of the south, and 200 feet from that to the north. It includes a space of about 20,000 square feet, and forms as it were an island in the ancient lake basin; for all round it the workmen found a depth of eight or ten feet of peat before they reached the bottom. This apparent island is what nobody had imagined, neither more nor less than the substructure of a lake dwelling.

We are indebted for the discovery to the Rev. Mr. Pupikofer. This gentleman, when examining the moor in June 1862, noticed, in a place bared of peat, parts of a fascine platform, together with fragments of stone hatchets, and a quantity of broken pottery. As he at once recognised in them the remains of a lake dwelling, he communicated the facts to his brother, Dean Pupikofer, the president of the Historical Society of Thurgau, who lost no time in visiting this remarkable locality, and in publishing the discovery. The Historical Society of Thurgau then took up the matter, and entrusted to Mr. Messikomer, well known as the discoverer of the lake dwelling of Robenhausen, the care of an excavation to be made at their expense. The results were published by Dean Pupikofer in the second volume of the Communications of the Thurgau Society; and contain, besides his own introductory remarks, an account of the settlement, founded chiefly on the report of Mr. Messikomer, a description of the objects found, and an accurate plan of a small portion of the settlement, made by Mr. Hasenfratz.

The following is the substance of Mr. Messikomer's report:—

'As the water was considerably lower this year and the peat was drier, the labour of investigation was materially lightened. The labourers had often come upon stems of trees and upright piles, but nobody knew what to think of them till the substructure of the dwelling, and a number of burnt objects, such as wheat, barley, and bread, together with fragments of pottery, proved that the place was formerly a lake settlement.

'When I began the excavation with a few workmen on the 18th of June, I was surprised to find, under a pavement of clay and gravel, from two to four inches thick, and from the top of which three feet of peat had been removed, a structure of fagot-sticks regularly laid and perfectly solid; and as the wood was exceedingly soft, we had to use every care in uncovering as large a portion of it as we could. We first bared a space which was in perfect condition, twenty feet long, six feet wide at the ends, and ten feet wide in the middle. The upper platform was of split timber or boards of oak, laid down with great care, and it rested on round timber, or fagot-sticks, from three to four inches in diameter, which were surrounded with piles. The back part of the space was covered with charcoal, and was somewhat charred: there were also found tolerably large stones (hearthstones) in their original position. A most striking fact was that the lowest part of the side wall was still standing; it consisted of a kind of shutter pushed in between the upright piles surrounding the space. On this I had other portions uncovered, and everywhere met with the same construction, only differing in having the platform or floor made of fagot-sticks instead of boards. Here and there the floor had sunk considerably, often one or one inch and a half in six inches.

'This place was then left to be examined by the members of the associations of Thurgau and Zürich, and excavations were made in another place to examine the substructure. The result proved no less interesting; for one foot deep, under the first platform, we came upon a second; a foot deeper we found a third; then a fourth, and so on; so that the arrangement is similar to that of Wauwyl. The huts were placed on masses of wood, consisting of five or six platforms, one above the other, the spaces between which were filled in with brushwood and branches of trees, chiefly alder, rushes, gravel, and clay. We were surprised to meet with bones, cones of earthenware, and a great wooden mallet *between* the platforms; we also found woven cloth under the fifth platform, and charcoal close to the bed of the lake. From this I conclude that the platforms were not made at the same time, but at intervals one after the other; or that they had been repaired, a portion at a time, as we found single charred stems under fresh wood.

'With a view to investigate the settlement in every direction, fresh excavations were commenced in a place where the peat had never been dug; so that by going carefully to work the uppermost platform might be seen in its original state. By the advice of Dr. Keller, a space of twenty-five feet square was marked out, and the peat carefully removed, and the sketch made by Mr. Hasenfratz shows the appearance and the mode of construction of the platform supporting the huts. (Plate XVI. figs. 1 and 3.) On this small space perfectly separate dwellings might be recognised, the size of which was indicated by the upright piles, often with the bark still remaining. In one case the regular fascine mode of erection was to be seen, in another a lattice or trellis work; so that we may conclude that these two buildings were used for different purposes.

'The plaster floor, which was three or four inches in thickness, doubtless served to keep out the damp. The fascine work had, as usual, sunk so much, that in order to restore the level a considerable quantity of gravel and clay had to be laid down: in one place the thickness of this plaster floor was more than a foot. What I have called the lattice or trellis work consisted of thin stems of trees, which were not laid close together, but at intervals of from one to two inches apart; the uppermost stems rested on others lying under them at right angles, and these again on others parallel with those on the upper layer. The spaces between the timbers were filled in with charcoal and burnt clay.

'The two dwellings which we excavated did not touch each other, but stood about one and a half or two feet apart. In this space there was a row of upright piles, of which some were clearly intended to keep together the substructure, and others to form the walls of the hut and to support the roof. The stems forming the trellis and those of the fascine erection overlapped one another. The fagot-sticks (Knittel) consisted either of young stems partially cut through in lengths of six feet, and then broken in two, or of older trunks felled in the same way by a cutting instrument, not by means of fire, and afterwards split.

'In the narrow space, only a few feet wide, between the two habitations, we found broken stone hatchets, corn, burnt platwork of flax, &c.

'We cannot imagine that this settlement was destroyed by fire, for although we occasionally met with burnt beans, not a single trace of conflagration was to be seen in the upright piles, which projected as much as two feet and a half above the floor—nay, even in most of them the bark was still in good preservation.

'The products of the potter's art were in general very coarse, and yet we found a few fragments which had been ornamented, and also parts of the rims of vessels made with washed or purified clay and without quartz-grains. Fragments of vessels also were found neatly polished, blackened, and with handles of a convenient form. No smaller implements were met with, such as pins, little chisels, &c. It is very singular that so few bones were found: the cow, the stag, and the pig were the only animals the remains of which were discovered here.

'At the bottom of some broken earthenware vessels there still remained grains of wheat and barley and hazel-nuts: doubtless all the food, whether animal or vegetable, was kept in large or small vessels of earthenware.'

Amongst the objects found at Niederwyl was an oak mallet, fourteen inches long, which evidently had been worked by stone hatchets, and clearly had been used for driving in the piles. (Plate XVI. fig. 7.) A similar mallet is in the collection of Colonel Schwab.

Plate XVI. fig. 5. A beam with mortise holes.

Plate XVI. fig. 6. A cone of baked clay, perforated towards the top. Several specimens of this kind of implement, both larger and smaller in size, were found here; they were used as weights for stretching the warp in weaving.

Plate XVI. fig. 4. The upper end of a pile, with a hollow cut in it for the reception of a cross-beam. Similar piles are found at Castione (see Plate CXII. fig. 2), at Robenhausen (Plate XIII. fig. 7), and in other lake dwellings.

Plate XII. fig. 1 is the sketch of a large implement, if it may be so called, made either of elm or ash-wood, and hewn with stone celts or knives. Both sides are alike. There are several places in the side arms where apparently the wood was cut thinner. It would be useless to mention the different opinions respecting this very problematical specimen, for none of them seem to be of any value.

Amongst the later discoveries at Niederwyl is a black earthenware vessel, drawn Plate CL. fig. 4, found there by Mr. Messikomer in September 1876. It is remarkable on account of having a crack in it, which has been mended by a plentiful application of asphalt, both inside and outside, evidently showing the value which the lake dwellers placed upon these earthenware vessels. Another cracked jug has been mended by having bast wound round it.

To complete our knowledge of this singular settlement, we will now refer to two sketches, which probably will give a more vivid idea of the place than the actual ground plan.

Plate XVII. is the sketch of a small part of the lake dwelling from a photographic view taken in 1862. In the middle may be seen a sandstone plate belonging to the hearth, lying upon a flooring of clay and gravel. To the right of this there are two rows of pile-stumps running diagonally through the picture towards the shovel; these piles mark the outer walls of two houses, and, consequently, the space or passage between two rows of huts. Still more to the right may be seen another flooring, on which a hearth was also found. It should be mentioned that the hollows between the stems of trees were originally filled in with clay, but that the water with which this platform has been covered for thousands of years has softened and washed it away. Unfortunately, this view was not taken till a large number of the pile stumps had been destroyed, as they were exceedingly rotten, so that neither the exact size nor the divisions of the huts could be ascertained with certainty.

The second sketch (Plate XVI. fig. 8, by the translator) is of less importance, as it was not taken till the summer of 1864, after the settlement had been exposed some time, and of course had been considerably injured by the summer sun and the winter frost; still, to those who had never seen a fascine structure it may give some idea of its appearance. The first impression probably would be that the stems had been as it were woven together, and that it was neither more nor less than a huge floor of wattle-work: this, however, is not the case; the appearance entirely arises from the soft or rotten state of the sticks, some parts of which, as they cross one another at right angles, must necessarily have projected more than others, and, being more exposed to the wearing influence of the weather, have decayed away, leaving those portions in the hollows more perfect, and thus giving the appearance of wattle-work above referred to.

LAKE OF WAUWYL.

We are indebted for our knowledge of this settlement to the care of the proprietor, Colonel Suter of Zofingen; the investigation of it was carried on under his direction and at his expense. This little reedy or 'moorland lake' is situated in a wide open valley of the canton of Lucerne, not far from the small town of Sursee, and in earlier times must have been of considerable extent. About eight years ago it was nearly laid dry by artificial drainage, and three years after, when the labourers began to cut the peat, they came upon a kind of wooden stage of considerable extent, on which a great amount of labour had been spent, but the whole had been covered over with peat apparently for centuries.

This settlement, which belongs to the earliest or stone period, agrees in many respects with that of Niederwyl, but probably approaches quite as nearly in structure to some of the Irish crannoges described by Sir W. R. Wilde. Like them, it is built up of many layers of trunks or stems, arranged crosswise in all directions one over the other: this mass of wood was placed on the bed of the lake, fixed there, and so made a firm and immovable foundation. It is further remarkable that the platform has been preserved beneath the sheltering growth of peat, and that within the area a certain kind of arrangement may be noticed, the position of the piles betokening the property of different families.

The following is the substance of the report given by Mr. Suter, the son-in-law of Colonel Suter:—

The whole structure consists of vertical piles driven more or less deeply into the lake bottom, and of horizontal trunks or stems lying one over the other between these piles in various directions, sometimes at acute but chiefly at right angles to each other. These horizontal stems form platforms, of which there are as many as five laid one over the other. (A sketch of these five platforms, taken by Mr. Nager from an actual measured space of ten feet square, is given on the left side of Plate XIX., and a section, in Plate XIX. fig. 4.) The lowest rests on the bed of the lake; the thickness of the entire series is now about three feet. There are no heads of piles on the surface of the lake bottom which might have supported the horizontal beams of the lowest platform; in fact, in the whole space which was excavated not a single vertical pile was found which had been used as a support for any horizontal timber. Two different platform systems are often in a measure bound together by many of the stems of the uppermost platform of one system projecting into the second of another system, thus forming a kind of passage-like connection rising up in the form of steps, which probably may be about four feet broad. The whole of the timber consists of unhewn round stems. No incisions or notches are found on any of the upright piles, and in the horizontal round stems there are no parts flattened or cut away, nor is there any other mode of binding the wood together which would require anything but the most simple tools. Not a single hole is to be observed in any of the timbers, and a wooden nail or spike has never been noticed. The horizontal stems are merely placed close to each other, as shown Plate XIX. fig. 5; and at the points where some of them cross each other, and which may be considered as the frame of the platform, there are upright piles between which the stems forming the frame have probably been thrust. In some places one might be led to think that these platforms could easily have been moved upwards and downwards between the upright piles. The vertical piles everywhere project at least a foot above the uppermost platform.

The interspaces or joints between all the horizontal stems are filled in with clay, and underneath, that is between the platforms, there are all kinds of branches and brushwood mixed also with clay.

Occasionally some of the upright piles might be observed, the upper end of which had been sharpened into a point by fire.

On the area excavated up to the present time a space about ninety feet long by fifty broad may be pretty clearly seen, which appears to have been covered with platforms of different heights. Around this rectilinear space, which was probably the substructure of the houses of one family, there are groups or bands of upright piles four or five feet broad, and often broader, driven in quite irregularly, and without any horizontal stems lying between them.

These bands of independent piles project almost in every direction beyond the corners of the rectangle, and in the direction of the sides, as is shown Plate XVIII. fig. 3, and this fact seems certainly to indicate the existence of other similar platforms being near—a supposition which is borne out by the fact that exactly similar structures are found less than a hundred feet from the rectangle just described, and also in a south-easterly direction on the moor road from the lake of Wauwyl. Similar traces are also found in several places in the neighbourhood, which indicate a very extensive settlement; these are marked on the plan of the district (Plate XVIII.), made by Mr. Nager, civil engineer.

Let us now for a moment examine the use of the upright piles which stand independent or apart from the regular structure. They may have served either, first, as fixed stays, to secure the structure from bulging in a horizontal direction; or they may, secondly, have been useful as defences against hostile attacks; or, lastly, they may have served as supports for passages or stages from one structure to another: some of these passages have actually been found.

Plate XVIII. will probably give a clearer idea of the locality and of the mode in which both the upright piles and the horizontal timbers were placed. Fig. 1 gives a section of a part of the Wauwyl lake. The expression 'Weisser Grund,' or shell-marl, means, as is well known, a bed of white chalky substance consisting of the shells of innumerable fresh water mollusca, all disintegrated and converted into a fine calcareous powder; it is found in all the moorland lakes of Switzerland, and is from one and a half to two feet thick; in some places it is even four or five feet in thickness.[1] Beneath this bed is sand, and below this is 'Grien,' or gravel, or sandstone. At the age of the lake dwellings the peat which afterwards grew up and buried the remains of the burnt settlement a fathom deep did not exist, or, if it did, it was only to a very small extent, for all the antiquities discovered here lay immediately upon the shell-marl. But here, as was the case with several other settlements in the moorland lakes, the peat began to increase very soon after the colony was founded.

In order to see how deep the upright piles went into the lake bottom, two of them were pulled up: the longer one went through about four feet of peat, and about eleven feet into the lake bottom; on the other hand, the shorter one passed through four feet of peat, and only went four feet nine inches into the lake bottom (Plate XVIII. fig. 2). As the excavation was made in a locality where peat had formerly been dug, it is to be presumed that the piles were formerly much higher in the peat. The thickness of the peat here was five feet ten inches. The lower ends of the two piles pulled up show that very imperfect instruments were used, for they are rather bluntly wedge-shaped than pointed (Plate XIX. fig. 6). In general, the upright piles are three, three and a half, four, and four and a half inches thick.

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[1] Shell-marl precisely similar in character is, I am informed, found beneath the peat in all the Irish bogs. It affords the best evidence that at a former period a lake of clear water existed which has gradually been displaced by the growth of vegetable matter forming peat.—[Tr.]

It may be well to remark here, that no implements or animal remains were found under the horizontal platforms, but by far the larger proportion in the enclosure which has been described, or on the outside of it. This fact confirms the supposition that the dwellings stood in water, that is, that they were surrounded by water the whole year, for the inhabitants, however little they may have cared for such things, would not have thrown the animal remains in the immediate neighbourhood of their abodes had it been dry, on account of the bad effluvium which their decay would have occasioned.

Before the lake of Wauwyl was drained and excavated, the surface of the water often rose to the level of the upper bed of peat in the place where the settlement was discovered, and a piece of neighbouring moorland of some extent, called the Zitteri, could not be passed over without causing a tremulous motion: the peat was, in fact, nearly saturated with water up to the surface. If we bear this in mind, and also what has before been mentioned, viz., that probably no traces of peat existed at the time of the lake dwelling, it follows with tolerable certainty that at that period the lake was here four or five feet deep. If, therefore, the structures were permanently placed in water, the question next arises, were they floating, that is, fixed rafts? or were they motionless? that is, did they stand firmly on the lake bottom?

There appear to be grounds for both opinions. For the first supposition, namely, that the entire mass was a fixed raft or float, the following reasons may be given:—

1. There have never been found any piles driven into the lake bottom under the lowest platform which might have served as supports for it.

2. The five platforms lying one above the other in the excavation of ten feet square were, as above mentioned, altogether only three feet in thickness, and therefore it is not probable that these five platforms filled the whole space between the surface of the water and the bottom of the lake; in addition to

which it seems pretty certain that all the platforms were not constructed at the same time, but that a new one was added above as it was wanted.

3. The step-like joining of the unconformable platforms (to use a geological term) of the different systems, as described, does not contradict the idea of a fixed float, for they are so constructed as to allow a rise and fall in the water-level.

If the idea of a fixed raft be considered probable, then the upright piles were intended to serve in a vertical direction as stays or guides for the horizontal platform.

The following are the arguments in favour of the view that one platform lay upon another from the bed of the lake upwards:—

1. As the lowest horizontal platform lies immediately on the lake bottom, and there is a layer of all kinds of brushwood and clay between each bed, the five platforms may originally have been considerably more than three feet thick, and thus may have reached above the level of the water, and they may in later times have been compressed to their present thickness by the mass of peat above them. As a proof that very great changes have taken place in the lowest part of this structure, the fact may be mentioned that when the lowest stage was examined (see Plate XIX.), which was done with great difficulty, the horizontal stems could not be clearly distinguished, nor could the upright stems be here recognised at all, though they were quite well preserved in the higher platform.

2. The vertical piles are in many cases joined in such a manner with the horizontal ones that the conclusion seems imperative that the latter were jammed in between the upright ones—a fact which would indicate fixed, not movable, platforms.

3. No traces of anything like wooden bands were found joining one horizontal platform with the others, which probably would have been the case in an actual floating raft.

With respect to the mode in which the vertical and horizontal timbers were joined, it may be well here to mention that in the sketches elucidating the structure it might appear as if the horizontal stems were pierced through in many places by the upright ones; but this is never the case. The horizontal stems are either pushed closely up to the upright piles (fig. 2, Plate XIX.), or they are squeezed between two upright ones, and the apparent piercing of the horizontal stems is neither more nor less than a consequence of the lateral compression of the softened wood. (Fig. 3, Plate XIX.)

In the course of the excavation it occasionally happened that wood was met with apparently in the shape of boards, but a careful examination showed that they were only round stems, placed one above the other, and compressed. In fact, through the whole structure no boards were found, but only round stems. In one case a piece of timber several feet in length projected probably a foot above the level of the uppermost platform, and had every appearance of a thick board placed on its edge, but on examination it proved to be only a round stem, the convex surface of which, being soft, had been shovelled away by the workmen (Plate XIX. fig. 1), and it proved to be the uppermost piece of many other round trunks placed one above the other, the spaces between them being filled in with extraneous material. It is not improbable that the long stems which had the appearance of boards, but afterwards proved to be a combination of many stems laid one upon another, and pressed together, may have formed the lowest part of the side-walls of rectilinear huts, thus differing from the huts of wattle-work and clay in other lake dwellings, and, like the log-huts or granaries of the Alpine districts, being built of unhewn trunks of trees.

All the vertical piles project considerably above the uppermost horizontal platform, and in earlier times may have been still higher, so that they may with great probability be considered as portions of the walls of the huts and supports for the roof; they are almost always arranged at right angles, so that it seems certain that the ground plan of the dwellings was in the form of a rectangle, a figure which would be erected much more easily, and which would better agree with the arrangement of the round stems forming the platforms: none of the piles are found placed in a circular form. The restored or ideal sketch at the top of Plate XX. shows the probable division of the particular houses according to this view, though in one respect it may not be quite correct, for from late discoveries some at least of the houses stood much nearer together than they are here represented.

A considerable quantity of charcoal from round or unhewn timber is found amongst the ruins, but no remains of the burnt clay covering of the walls with impressions of wattle-work, such as is frequently found in other lake dwellings which were evidently destroyed by fire.

The kinds of wood used in this structure were oak, alder, and fir. The dimensions of the horizontal stems varied: those of oak were the thickest, and measured five inches in diameter, or even more, while the other sorts were only three or four inches thick. It is a singular fact that the oak-wood showed less solidity than the fir or alder: all the stems had the bark on; it was preserved entire on the alder.

Some of the antiquities found at Wauwyl are drawn on Plate XX.

Fig. 1 is the sketch of a long pebble, probably used for stirring up the melted asphalt.

Fig. 2. Celt of serpentine set in a stag's horn hafting. Several other celts both of quartz and serpentine were also found.

Fig. 3. Bowl made of yew-wood.

Figs. 4 and 12. Fragments of pottery; the outside is partly covered over with asphalt, and the inside covered thickly with soot. The material of this pottery is unwashed clay mixed with a large proportion of quartz-grains. Earthenware vessels, or rather, unfortunately, the fragments of them, were very abundant: hardly any were obtained perfect.

Fig. 5. A roundish stone of coarse-grained sandstone, similar to those found in other lake dwellings.

Fig. 6. A piece of sandstone with the hollow caused by stone celts having been ground down upon it; several varieties of these grinding-stones were met with.

Fig. 7. A glass bead of a bluish-white colour when the light falls upon it, but of a honey-yellow when held between the light and the eye. The bluish colour of the glass arises from the mixture of lead. This bead, though apparently unimportant in itself, is of great interest from having been found in this locality: it may probably throw some light on the date of this settlement, which was founded, and, as it appears, also came to an end, in the period known in the history of civilisation as the stone age. This small ornament, in fact, affords indubitable proof that the inhabitants had intercourse with the more civilised nations on the coast of the Mediterranean, who had made great advances in the arts, while they themselves were in the lowest stage of development. This glass bead is quite similar in form and colour to those found in the graves of the earliest inhabitants both in Egypt and in nearly all the western countries, and which have also been met with in great numbers in Roman settlements. These glass objects of the earliest times may either be of Egyptian or of Phœnician origin, for in both countries glass manufacture was carried on, in the former more anciently, and in the latter less so; but it is improbable that these productions came into Europe in any other way than by means of the Phœnicians, for there can be no doubt that in a similar way they were the first who brought the tin of Britain into the commerce of the world, and who taught the inhabitants of southern and western Europe the use of bronze, which had already been used in ancient Egypt for the preparation of tools.[1] Just as the fact of finding in all the lake dwellings and in the oldest Celtic tumuli and graves, tools of noble nephrite, a kind of stone universally allowed by mineralogists to belong only to the East, gives us a proof of barter in the earliest times between Europe and farther Asia, so, as history affords us some information as to the origin and continuance of the Phœnician trade, this glass ornament gives us a chronological datum for determining the age of the lake dwellings, which, however insufficient it may be, yet expressly forbids us to throw back their existence to a period many thousand years before our era.

Fig. 8. A lump of asphalt which was used for fastening celts, arrow-heads, saws, &c.

Fig. 9. Knife made of yew-wood.

Fig. 10. Awl or piercing tool made of stag's horn.

Fig. 11. Saw made out of the bone of a small quadruped.

Fig. 13. Bead made of stag's horn.

Figs. 14 and 15. Fishing implements (floats?) made of wood or bark.

Fig. 16. Cutting instrument made of a boar's tusk.

Fig. 17. Flint knife of the usual form and size.

Figs. 18, 19, 20. Chisel-shaped implements made of the long bones of quadrupeds.

Figs. 21, 22, 23, 24, 25. Piercers or tools made of sharpened portions of the long bones of small animals.

Fig. 26. A barbed dart or harpoon made of stag's horn.

Recent excavations at Wauwyl by Colonel Suter of Zofingen have produced several objects of interest, and also some additional information. The following notices of the additions made to the Colonel's collection have been kindly sent by his son-in-law, Mr. Suter.

Amongst the animal remains lately found are the skull of the marsh pig and the bones of the bear (*Ursus arctos*). A large number of stone implements have been met with, the most interesting of which is a celt of nephrite, the largest I have seen, for although broken, it is three inches long and fully two inches wide. Amongst the implements of bone there are some tools hitherto unknown; they are made of pieces of stag's ribs from eight to eleven inches long, one-half of which is in its natural state, or is only a little ground down at the edges; the other part is sharpened at the end, and has a deep incision in the middle down to a third or nearly one-half the length, so as to give the appearance of a two-pronged fork. In all the specimens found, of which half-a-dozen have been met with at Wauwyl, and several exactly similar at Robenhausen, the prongs or teeth, both inside and out, have been perfectly made smooth, apparently from long use, while the other end is left in the rough. The fact that two or more of these things are always found together, as well as their form, leads to the supposition that they may have had something to do with the preparation of flax, and may have been used as heckles. Some of them are drawn, figs. 8, 9, 10, and 11, Plate XXII.

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[1] Amongst the sepulchral paintings of Beni Hassan, which, according to Sir Gardner Wilkinson, are 3,500 years old, is a representation of glass-blowing. The manufacture of glass beads is also drawn—one workman lays hold of the beads which are in the basket on his knees, while another workman bores holes through them with a drill.

Amongst the objects made of horn, the hafting of a stone celt is worthy of notice: it is drawn Plate XXII. fig. 7. Amongst those of wood may be mentioned that drawn fig. 12, which is also a hafting or club for a celt. Figs. 17 and 18 are ornaments or implements of stag's horn.

A fresh excavation has been made by Colonel Suter in the peat moor near No. 5 in the plan on Plate XVIII., about fifty feet long by thirty feet broad, and Mr. Nager, civil engineer, has kindly sent me drawings of the different layers of wood and sections of the excavations. But as the construction is precisely the same as that previously described, it will be needless to repeat the particulars; some of the notices, however, sent by Mr. Nager are of considerable interest, amongst which is the following:—

'In the place excavated in the year 1864, platforms of round timber were found everywhere with some piles driven in vertically. Upon these layers might be seen, at a distance of ten or twelve feet apart, three hearths made of unworked or rough stones, of different sizes, joined together with clay and sand, and arranged in the form of a half-moon. Charcoal-ashes and charred wood were found within them. Even the substructure, that is to say, the platform of round wood, was charred, and had been covered with sand and clay. Near these hearths the platform had sunk in some degree, probably from the weight of the people who sat around the fire and worked there, and also of the raw material heaped up here for making stone implements. For close by there was found a surprising quantity of flint refuse, as if it had been a regular workshop of this material. Half-worked and broken arrow-heads, as well as those which were quite perfect, and flint knives of various sizes, from 1½ inch to 4 inches in length, were lying on the surface, as well as pottery and stone celts, both solid and perforated; amongst the latter there was one which had its handle of ash-wood still remaining.

'Wherever excavations have been made in the moor in any part of the widely-extended lake-dwelling area, no actual pile erections have been found, but only the fascine structures, exactly like that of Niederwyl. It may, however, be remarked, that at Wauwyl there is great irregularity in the position of the individual logs of the same layer, as well as of the layers with respect to each other. It appears as if various deviations from a parallel arrangement of the logs had arisen, sometimes from fancy and sometimes from convenience, and the thickness of the logs. The platform in the place last excavated rests upon peat; in fact it appears as if the whole structure was placed upon it. It is, however, possible that when the settlement was founded, the peat which was at that time accessible may have been used as a material for the foundation in order to save timber. The weight of the earth placed on the platform has pressed down the trunks so much into one another as almost to give the appearance of their having been artificially joined. But hitherto I have not noticed in the lake dwellings of Wauwyl any artificial joining, not even the most common carpenter's arrangements, such as those which are called "mortise and tenon" and "notching."'

ALLENSBACH AND MARKELFINGEN, ON THE UNTERSEE.

It appears from late observations that nearly the whole shore of that portion of the lake of Constance called the Untersee is studded with the remains of lake dwellings; and judging from the implements hitherto obtained there, they belonged exclusively to the stone period. It is also remarkable that there are no traces of conflagration, so that the inhabitants appear of their own free will to have abandoned their dwellings on the lake, and to have settled on land before any kind of metals had been brought into use by commerce or barter.

A catalogue of all the known localities of lake dwellings in this part of the lake will be given in the geographical list, but the settlements in the neighbourhood of Allensbach and Markelfingen have been so carefully examined by Mr. Dehoff, that they require a separate notice, and we cannot do better than transcribe almost entire the account which he has given respecting them.

There are three lake dwellings in this neighbourhood worthy of notice.

1. A settlement above Markelfingen.
2. One about half-way between Allensbach and Markelfingen, adjoining the landmark of Reichenau.
3. A third reaching from above the mouth of the mill-stream at Allensbach up to Weiler Hegne.

All of these were examined as carefully as possible, and will now be described in detail, together with the antiquities, so far as they are of interest.

1. The settlement above Markelfingen is situated around a little island about thirty paces in diameter, and more than twenty minutes' walk from the village of Markelfingen. This island is about thirty paces from the shore in a north-westerly direction, and when the water is low is about half a foot above the surface, but when the water is higher it is entirely covered about a foot deep. The piles surround this little island on the west and north-west sides, not in any considerable number, but some-

what abundantly, as was seen at the lowest level of the water in the winter of 1862, when they were covered with a depth of more than three feet of water. There are no remains of piles on the island itself, but rather a large number of stone celts roughly made out of the rolled stones found on the bank were discovered there.

2. The lake dwelling above the one last described and below Allensbach, adjoining the landmark of Reichenau, is situated on a tongue of land, and stretches from east to west, with a tendency to north-west, for a length of about 1,000 paces. Probably for about a quarter of this distance the side of the settlement next to the shore was accessible dryshod; the rest of the piles stretch some distance into the lake. The little plan made at my suggestion by the Grand Ducal Board of Works in the interest of archæology indicates the arrangement of the piles (Plate XXIII. fig. 1). It may, however, be assumed with certainty that at least an equal number have been destroyed or carried away by the violence of the western storms, and probably many have been covered either by mud or the deposit from the stream, or by the gravel and rolled stones piled over them.

It is quite impossible, from the remains still existing, to lay down with certainty a definite ground plan of the dwellings, and the arrangement of the piles gives us no positive information as to the number of huts which once existed here; still it is very evident that the settlement was of considerable extent.

In one place the rows of piles take the direction of the mainland in such a manner, that they may with tolerable certainty be considered as the remains of the ancient entrance stage or bridge.

With respect to the kinds of wood used for the piles, amongst those which have been examined the softer descriptions, such as white and red fir and the willow, were found to predominate. The piles made of these kinds of wood were all whole or round stems, while some of oak were made of split trunks originally fourteen or sixteen inches in diameter. The piles only project about one or two inches above the bed of the lake; there was, however, one single round oak pile rising two feet higher than any of the others, the heart of which, about an inch in diameter, and fan-shaped though split, was in perfect preservation.

The plan shows at *a* the place where some beams lie in a horizontal position amongst the piles. I consider them as parts of the ancient superstructure. Some specimens which have been brought up show very clearly the structure of oak-wood; they appear to have been made of split trunks. These horizontal beams are fifteen feet long and from four to six inches in diameter: the place where they occur, even at the lowest level this year, was covered with two feet of water, so that further investigations were impossible for the present.

The nature of the ground throughout the settlement was as follows. First, the usual covering of a deposit of gravel about two inches thick or rather more, under which was the 'relic bed' from half an inch to 1½ inch in thickness, below which were many feet of the well-known shell-marl (blanc fond). In the north-western part of its area, as also in the places farthest in the lake, the covering of gravel on the bottom was entirely wanting, and a 'relic bed,' two inches thick or rather more, and almost like mud, rested immediately on the shell-marl.

The unfavourable influences mentioned above have either carried away or broken up the lighter remains, such as those of wood, horn, or bone. Some remains of enamel from the teeth of large mammalia seem to show that they had been rolled into fragments.

The heavier stone implements were consequently the only evidences of civilisation discovered. By far the greater number of them consist here, as elsewhere, of stone celts, varying most exceedingly both in size and form, and thus leading to the conclusion that they had been used for many different purposes. They vary from less than an inch to 21 inches in length, and from 5 lines to 3½ inches in the breadth of the cutting edge. Some, especially the larger ones, run somewhat to a point at the end opposite to the cutting edge, and near this end the stone has no doubt intentionally been made rough; evidently the tools of this description had been set in pieces of wood, horn, or bone, hollowed out to receive the celt: probably they were used in agriculture. By far the greater proportion of specimens of this kind have been worn much more on one side than the other, which seems to indicate this application of them. The other sort, with generally a broader and less curved edge, tapers less at the opposite end, appears more fitted for being held in the hand as a cutting tool, and shows the wearing of the edge more in the middle (pieces having flown off), while the first kind may be distinguished by being nearly blunted on one side.

Corn-crushers were found in great numbers, and also some flint saw-flakes without handles.

The rolled stones lying about close by evidently had afforded the material for the greater part of the celts; a small number of specimens, however, were met with made of serpentine.

Besides the celts just mentioned a specimen was found (drawn in two positions on Plate XXIV. figs. 10 and 11), which I take to be the front half of a battle-axe. It is of black serpentine from the Grisons; its length from *a* to *b* is 3 inches 3 lines; its greatest breadth from *c* to *d* is 2 inches 4 lines; the width of the haft-hole, which is made of a conical form, is nearly an inch in one direction and 10 lines in the other. This specimen has been worked with the greatest care both as to the exactness of the dimensions on both sides, if measured with the callipers, and also as to the mechanical finish, evidently produced by grinding. One in some measure approaching to it is drawn figs. 6 and 7.

Another specimen, new of its kind, is drawn Plate XXIII. figs. 3 and 4. The material seems to be Alpine limestone; probably the implement was made out of a rolled stone. The drawing will give the best idea of its form: the length from *a* to *b* is 3 inches 5 lines; the breadth from *c* to *d* is 2 inches 7 lines; the height or thickness from *e* to *f* is 2 inches 4 lines; and the height of the handle worked out is 4 lines. This implement, from its general appearance, seems to have been used as a crushing instrument, and yet it evidently has not been rubbed, like the specimens known as corn-crushers, on another stone, but on some softer substance, perhaps made of wood, for there are no traces of wearing on its under side. If it is allowable to hazard a conjecture, I would consider this specimen, taking into account the large quantity of raspberry-seeds found in the neighbouring settlements, as an implement for crushing fruits of this description in order to procure the juice.

Plate XXIV. figs. 8 and 9 give two views of an object, the use of which also is very doubtful, and respecting which I will not venture to offer an hypothesis. It also is made of Alpine limestone; the length is 3 inches 7 lines; the breadth 2 inches 4 lines; the thickness, including the raised part, 1 inch 5 lines; the elevation itself 2¼ lines. The upper surface, with the exception of the back or hinder part, which shows the natural fracture, is carefully worked, and in a similar state to the hinder part of those celts which have been intentionally made rough.

The rise in the middle, which has evidently been artificially worked out, is only a little smoother than the rest of the upper surface.

The use of the implement drawn Plate XXIV. figs. 2 and 3, is no less doubtful. The material is diorite. The upper surface is more carefully worked, and smoother than that of the specimen last described; it appears to have been ground. The length from *a* to *b* is 5 inches 1 line; the greatest breadth, from *c* to *d*, is nearly 2 inches. The thickness, including the ridge, is nearly an inch, and the height of the ridge itself is nearly a line.

Plate XXV. fig. 1 is the sketch of a stone intended for a hammer; it is, however, only half perforated; the section (fig. 7) will give some idea as to how this operation was performed.

Plate XXV. figs. 15, 16, and 18. This specimen appears to be an unfinished hammer made of serpentine: the under surface and the sides half-way up have been ground, while the other part of the sides and the upper surface is worked entirely in the rough. The letters *f*, *d*, *a*, show the ground under surface; *e d* the portion of the side which has been ground, and *e c* what has been left unworked. Towards the front from *d* to *a* the under surface is sloped outwards in the form of a skate. The length is 5 inches 1 line; the greatest breadth from *g* to *h* is 2 inches 8 lines; the smallest breadth from *i* to *k* is 2 inches, and the thickness from *c* to *d* 2 inches 1 line.[1]

Plate XXV. figs. 9 and 10 is probably a corn-crusher, but of a somewhat peculiar form; it is particularly remarkable for having the two surfaces rubbed quite smooth. The length is 3 inches 4 lines; the greatest breadth from *f* to *e* is 2 inches 4 lines; the smallest from *g* to *h*, is about 2 inches. It is remarkable that not only the part *c d*, but also both the slopes *a c* and *d b*, still bear unmistakable traces of rubbing down, by which regular sharp ridges have been made at *g*, *a*, *h*, and *f*, *b*, *e*.

The specimen drawn (Plate XXV. figs. 2, 3, and 8) is also one the object and use of which must remain conjectural. It is not easy to decide as to the material, for it is incrusted with a coating of calcareous matter, which cannot be removed without injury, but it appears to be of sandstone. The length is more than 5 inches; the greatest breadth from *c* to *d* is 2 inches 5 lines; the greatest thickness from *e* to *f* rather more than an inch; the thickness in front is 4¼ lines. The workmanship is throughout of the best description, and the specimen appears to have been ground all over.

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[1] Unfortunately the lithographer who printed this plate from transfers sent from Zürich, has by mistake erased several of the letters referred to above in this and the following specimen, and as the plate is now printed off, it is too late to be altered; but the letterpress will, it is hoped, be understood without these minute references.—[Tr.]

The stone celt drawn (Plate XXV. figs. 11 and 12) is of a peculiar form. The cutting edge is sloped or curved down on the lower side, and at the hinder end there are on both surfaces corresponding circular depressions cut out more than 8 lines deep, and these, together with the peculiar form of the edge, make the specimen appear like an axe. The length on the upper side from *b* to *c* is 5 inches. On the under side from *a* to *d* is 4 inches 2 lines, the diameter of the base from *f* to *g* is very nearly an inch, and the diameter of the upper surface 1 inch 6 lines. The material cannot be determined with certainty, on account of the thick coating of chalky substance, and yet from its greenish-grey colour and the fineness of the grain which may be seen in some places it probably may be serpentine.

The lake dwelling in the north-west bay close by Allensbach has yielded no small number of stone celts, but all entirely coated with chalky mud, and also a hammer like that drawn in Plate XXXIX. fig. 5. The boring of the haft-hole is not finished, but is only carried to a depth of 1 inch 8 lines; the diameter of the hole is 8½ lines, and at the bottom the central portion projects about 4 lines high. Besides this one, three unfinished specimens of similar forms were found here, partly ground and partly only worked out of the rough.

3. From a little above the place where the mill-stream of Allensbach falls into the lake up to a point below Weiler Hegne, and consequently in an easterly direction from that just described, a very large lake dwelling extends nearly half-an-hour's walk in length, the whole distance being clearly marked either by actual piles or by the discovery of stone implements. The piles begin about 300 paces above the last houses of Allensbach, at first only to be recognised in a single row, afterwards two rows are seen, and lastly, in a place which goes by the name of 'beim Eichle,' on a gently sloping shore, an extensive settlement appears covered with a number of piles in four and sometimes in five very distinct rows.

The single row runs close to the land, the other thirty paces out in the lake and parallel with the shore. The shape of the dwellings erected on this area, according to the arrangement of the piles, has doubtless been a quadrangle. The place is for the most part only covered with water when it is at its highest level, but at all times of the year the approach to it from the mainland must have been practicable almost without any scaffolding or stage. The land immediately adjoining to it, now made into meadow, was a forest not very many years ago. Bearing this in mind, there could hardly be found a more secluded place for a settlement than this locality, lying in a bay sheltered on both sides by the projecting forest, and probably only visible on the side of the lake.

The upper surface of the lake bottom towards the mainland has a thick covering of gravel, under which there is a considerable bed of white sand. Most of the antiquities are found at a depth of one or two inches, but the pottery afterwards to be noticed is found deeper, and as much as five inches under the surface. A 'relic bed' can only be seen in some places, and more especially in those which are situated at a higher level; in the lower parts the covering of gravel rests immediately on the shell-marl.

The antiquities found here consist chiefly of stone celts, the majority of which exhibit workmanship indicating an extraordinary degree of skill. Some few, especially the smaller specimens, are not only ground on the whole upper service, but seem regularly polished, and might fairly pass as ornaments or objects of the toilet table. Plate XXV. fig. 4 gives the form of a specimen finished in this manner. The material is said to be diorite. The length is 2 inches 4 lines; the breadth at the cutting edge 1 inch 7 lines; the breadth at the hinder end is 4¼ lines, and the thickness in the middle is also 4¼ lines.

Besides these there were found here very beautiful saws of yellow flint, and also the lance-point of black flint, drawn Plate XXIII. fig. 6. This specimen is 2¾ inches long; its greatest breadth 1 inch 2 lines, and the thickness at the lower end 2¾ lines.

As fragments of charcoal and broken pottery were here lying scattered about on the surface, it was deemed advisable to excavate, and within the area of a few paces three earthen vessels were discovered. They were all of the most primitive form, only about four and a half inches high, and a little bulged: they had no handles, but holes had been roughly bored at the upper edge, through which cords might be passed. They were mostly so weathered and rotten, that notwithstanding the greatest care

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they could only be taken out in pieces. The material is a mixture of clay and loam, to which grains of coarsely powdered quartz are added. It may be seen at a glance that these vessels were made by the hand alone, and show no trace of any skill in workmanship: the sides were from 4½ to 8½ lines thick. One of these vessels, which had a thick coating of soot in the inside, was filled with a grey mass like ashes mixed with pieces of charcoal, in which there was a very friable great bone of one of the extremities of an animal. A second vessel, also coated inside with soot, contains a brownish mass of earth, the nature of which is now under examination by Mr. Leiner of Constance. The third vessel, in which no traces of soot were discernible, was filled with wild hazel-nuts and their shells, made black or blackish-brown, but still in good preservation. The fragment of a hammer, drawn Plate XXV. figs. 5 and 6, was found immediately above this place, about half an inch deep in the gravel. The material is serpentine; its length from the point to the haft-hole is 3 inches; the greatest breadth is 2 inches 2 lines; the height 1 inch 7 lines; and the width of the haft-hole 8½ lines.

The specimens drawn Plate XXIV. figs. 1 and 4, consisting of flat almost unworked rolled stones from 4 to 5 lines thick, and from 3½ to 4 inches in length, show no further traces of workmanship than the hollows or furrows at *a* and *b*; they may probably be considered as sling-stones or as weights for nets.

Only a few piles are to be seen in that part of the bay to the north-west of the landing-place of Hegne; most of it is covered over with mud, and it is partly dry when the water is very low. A considerable number of celts made of serpentine and diorite, some few fragments of flint, and the remains of great mammalian teeth, have been found here.

The stone celts from this place nearly all exhibit more careful workmanship than usual.

Further excavations here, as well as all the way to Allensbach, would be very likely to yield good results when the water is at its lowest.

The series of lake dwellings on the northern shore of the Untersee may probably close with the settlement of Hegne. The wide lake bottom stretching from the landing-place of Hegne to the old ruins of Schopfeln (Scopula) on Reichenau, is chiefly clay ground, almost without a single rubble-stone. This muddy shallow extends so far into the lake that the inhabitants of the lake dwellings, if there were any on this locality, must have passed three quarters of the year in a regular marsh, and their egress must have been exceedingly difficult, and often more than a thousand paces in length. Besides this there is a dearth in the whole space of one of the necessaries of life, never, to my knowledge, neglected by any of the builders of lake dwellings, viz., fresh water in the immediate neighbourhood.

The same remarks will apply to the shore on the other side of the ruins of Schopfeln at what is called the marsh of Wollmatingen, till the Rhine is reached; after which, as the river becomes deep only a very few paces from the bank, and there are no springs of fresh water to be found in the flat marshy ground immediately adjoining all the way to Constance, not a single favourable locality could be found for the erection of this description of dwellings.

The nature of the ground is far more favourable on the other side of the tongue of land in that part of the lake of Constance which goes by the name of the Ueberlinger See.

UEBERLINGER SEE. (WESTERN SHORE.)

THE lake dwellings in this district were examined some years ago, and reported on by Mr. Dehoff, and they have also lately been carefully investigated by Mr. Ley. It will probably be better to give the substance of these two reports independently, and we will now take the first in the order of time, which is that of Mr. Dehoff.

'The lake dwellings on this shore extend, though not continuously, from the bay in which lies the island of Mainau along the shore near Lützelstetten[1] and Dingelsdorf to the north of Wallhausen, a distance of more than two hours' walk. Throughout the whole of this tract stone celts are found, chiefly of serpentine, also in many places corn-crushers, mealing-stones, and pottery.

'From Wallhausen nearly to Bodmann the chain of hills along the bank, consisting chiefly of "molasse," slope precipitately into the lake, and consequently here, from the limited space and the rocky bottom, the locality is by no means fitted for lake dwellings; they are not again seen till the chain of hills retreats and becomes lower opposite to, and more especially above, the borough of Bodmann.

'Here there is a large lake dwelling about four hundred paces in length, extending from the landing-place to the turn of the lake northwards towards Ludwigshafen.

'Three distinct rows of piles may be noticed in many places, but unfortunately, from their proximity to the land, they have been partially destroyed, and will very soon be entirely annihilated.

'The width of the piled space from the side nearest to land to that farthest in the lake varies from twelve to twenty feet;

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[1] Mr. Ley, of Bodmann, at the close of his report on the settlement near his own town, mentions that the lake dwelling of Lützelstetten is about a quarter of an hour's walk from the town, and stretches out into the lake covering five or six acres; stone celts, whetstones or grinding-stones, pottery, and spindle-whorls are found there. The settlement at Wallhausen is much larger, and runs along the shore, and stone celts and flint implements are found there in such numbers that the collectors call it 'Flint Island.'

the shape of the settlement erected here appears to have been rather a long rectangle.

'A few feet from the shore the bed of the lake is covered with a "relic bed," varying in thickness from several inches to more than a foot, which is richly studded with bones and teeth of animals, remains of stags' horns, and implements made out of these materials or of stone—or, to speak more correctly, it is filled with them.

'Flint remains were found in one locality, about thirty paces long and about ten paces broad, in very great, and, in fact, in astonishing quantities. They consist not only of chips and refuse of every size and form, from pieces hardly worked and the size of the fist to the smallest fragments, but of saw-flakes, cutting-tools, and arrow-heads, all of which were found in considerable numbers. The abundance of flint remains here is the more astonishing, as this locality before the invention of lucifer-matches, and as far as the memory of man goes back, supplied the whole neighbourhood with the flints they required, and was actually worked as a business for this purpose.

'The flint implement drawn Plate XXIII. fig. 2 was, probably, used for taking the scales from fish.

'From what has just been said it appears that in this place there was an actual manufacture of flint implements for a wide extent of country, and this assumption has still more probability if it be taken into account that flint remains, and more especially flint tools, are not met with at all approaching to the number found here in any other lake dwelling of the surrounding district. This circumstance, taken together with the abundance of animal remains, may enable us to form some conclusion as to the age and duration of this settlement, though it must not be ignored that the favourable situation of this place was especially calculated to preserve these monuments of early times for later generations.

'The great number of pieces of stag's horn found here, partly worked and partly in the rough, deserve especial mention. By far the larger proportion of these remains appear to have been parts of horns which had been shed; pieces attached to the skull are very rare. All the specimens which I have seen belonged apparently to the red deer; several were found of unusually large dimensions, but not a single horn was got out entire.

'Some of the pieces of bone are of colossal size, and must have belonged to the largest species known in these parts.

'Many of the teeth found belong unquestionably to the horse; others, of very great size, are those of the ox tribe. Besides these there were found tusks of the wild boar, one of which was more than 3½ inches long; stags' teeth were also met with.

'Amongst the implements of stone, next to those of flint, the celts are the most numerous; they are chiefly made of serpentine, well worked, and ground at the edge.

'The fragment drawn (Plate XXIV. fig. 14) evidently is part of a hammer; unfortunately it is broken, not only at the haft-hole, but also at the point; the original form therefore is only conjectural. It is of serpentine; the whole surface, even that of the haft-hole, has been carefully ground and finished off. This fragment is 3 inches 2 lines long, the breadth in front of the haft-hole is 1 inch 7 lines; the height is 1 inch 3 lines.

'One of the most interesting specimens is probably the front of a battle-axe, drawn Plate XXIV. figs. 12 and 13. It is made out of serpentine, tolerably well finished, and ground all over. The length from *a* to *b* is 3 inches 1 line; the breadth of the cutting edge is 1 inch 7 lines; the width of the helve-hole 11 lines, and the whole breadth at this part 1 inch 10 lines.

'The fragment of a perforated spindle-whorl made of serpentine exhibits also the same careful workmanship.

'(Plate XXV. figs. 13, 14, and 17.) A wider stone implement, apparently an unfinished hammer of serpentine, which has been worked on all sides, partly by grinding and sawing, and partly by strokes of the hammer. A depression about seven lines deep has been made on one side, apparently the beginning of a hole bored with flint tools. The whole specimen is 4 inches 9 lines long; at the hinder end it is more than 2 inches wide; in front its width is 1 inch 9 lines, and the body is from 2 inches 4 lines to 2 inches 1 line broad.

'Amongst the bone implements found here there were several which are generally considered as netting-needles and small chisels.

'Amongst the implements of horn there was a particularly fine base of a stag's horn, with a hole through it, 1 inch 3 lines long by 1 inch wide at the outside, and consequently oval, about 9 lines under what is called the "rose-piece." The brow antler had been cut a line deep with a sharp tool, and then had been broken off. The length is 8 inches, the width at the head

2 inches 6 lines (Plate XXIII. fig. 5). An implement almost precisely similar was found at Robenhausen.

'Besides this there are several ends of stags' horn, which apparently have been separated from the main branch in a similar way to the brow antler just mentioned, then ground sharp at the pointed end and hollowed at the opposite one: this had evidently been done for some definite purpose; they probably had been used as a primitive kind of lance-points, or, on account of their greater hardness and durability, for some kind of agricultural tools.

'A considerable number of fragments of earthenware vessels were found, many of which had the well-known line ornaments. The material of these vessels had been much more carefully prepared than that of those found in the neighbourhood of Allensbach, the quartz-grains are smaller, and charcoal dust is mixed with the clay; the whole finish also of the work is further advanced, and the substance of the pottery is thinner and more in proportion to the size of the vessels, probably not more than 2½ lines thick; and yet they have not in any single instance been made with the potter's wheel.' (Plate XXIV. fig. 5.)

The above is nearly an exact copy of Mr. Dehoff's report, made in 1862. We have now to add a report of Mr. Ley of Bodmann, as to the excavation and investigations made by him very lately in the neighbourhood of this town.

'The little map on Plate XXVI. will show the localities of the two lake dwellings lately examined; they are indicated by the letters A and B.

'*Lake Dwelling* A.—The excavation undertaken in December last produced the following objects:—A great number of celts of different kinds of stone, either with or without the well-known stag's horn hafting. Amongst these is a very rare specimen of a flint celt (Plate XXVIII. fig. 31), several stone hammers, either with a round or an oval perforation; mealing-stones, corn-crushers, grinding or whetstones, flint saws (Plate XXVIII. fig. 32); the one drawn may probably be considered unique, as, like the northern saws of flint, it has a sickle-like shape; arrow-heads of flint; a bow of yew-wood (*Taxus baccata*) four feet long; bone chisels and piercing tools; clay spindle-whorls; an earthenware vessel with a handle; horns of the stag, the roe, the goat; bones of the pig, the horse, &c., and teeth of several carnivorous and herbivorous animals.

'This settlement, which belongs to the stone period, for, as yet no bronze implement has been found in it, appears either partially or entirely to have been burnt down, and after some considerable time to have been again inhabited. Upon the original lake bottom into which all the piles were driven, there is first a relic bed from half a foot to a foot thick, and upon this there is in many places a bed about 2⅓ inches thick, containing burnt matter. Above this again there is a layer of mud about 2⅓ inches in thickness, on which lies a second relic-bed from 2⅓ to 6 inches thick, and then comes a bed of gravel, sand, mud, &c., from 1¼ to 2 feet in thickness.

'In the lower relic bed there are fragments of roughly-made pottery and stone celts, stags' horns and bones in a very friable condition, and a quantity of hazel-nuts, &c. In the upper relic bed many neatly-made polished stone celts were found; some perforated stone hammers, which are not met with in the lower bed; stone chisels with haftings of stag's horn; well made bone chisels; stag's horns in a good state of preservation, and a better kind of earthenware, in some cases ornamented. From all this we may in the first place see indications of an advance in handicraft amongst the colonists,[1] and secondly, a decided proof that the locality was not inhabited for a considerable length of time, during which the bed of mud 2⅓ inches thick was accumulated.

'Bones, pottery, hazel-nuts, &c., are found in both relic-beds. The colour of the pottery is black or grey, and the clay has been mixed with fine sand. Flint-flakes are so abundant that I easily obtained a whole basketful. I lately found a vessel like that drawn Plate XXXI. fig. 6, and it contained about 600 beads, some of which are drawn Plate CXL. fig. 7. They consist, according to the determination of Swiss geologists, of *Diceras* limestone, a stratum which extends from Wangen near Solothurn to the Bernese Jura. The perforation of these beads, like that of the stone celts, has been begun from both sides (see the section *a b*). The thread on which they were strung fell to pieces when they were taken up.

'The piles in this settlement are of oak, fir, pine, round-leaved willow, aspen, birch, &c. Some are whole stems, some split, but all are quite decayed.

'*Lake Dwelling* B.—About 550 yards north of the settlement just described, at the end of the Ueberlinger See, I discovered, some little time ago, a number of piles driven into what is called the "slope" (Halde), where the lake suddenly becomes deep; they extend over at least ten acres, and come close to the shore; they project above the bottom from half an inch to two feet, and for the most part are in a better state of preservation than those of the lake dwelling at A. I remarked that some of the piles which I had drawn up from a depth of six feet, had been hewn with sharp cutting instruments, from which it appears that this settlement belongs to the bronze age. In fact, after searching in vain for a length of time for bronze implements, I succeeded in finding three bronze celts, of which two were of the flat kind and the other had shaft flanges; I also obtained a clothes-pin. Besides these, I got up from a depth of six feet four objects of iron; viz. 1 knife, 2 arrow-heads, 1 fragment of a fish-hook, also a mealing-stone and a fragment of pottery. The greater part of the settlement is covered deeply with mud, so that it is difficult to examine it.

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[1] This supposition is at variance with the observations made at other stations of the stone age. See the remarks made at the end of the account of the lake dwelling of Robenhausen.—[Tr.]

'The pottery is for the most part ill-burnt, and the clay has been mixed with coarse quartzose sand; most of the vessels are ornamented in a similar way to those from the other settlement, and in neither case has the potter's wheel been made use of. It is a singular fact, though the quantity of mud renders it difficult to ascertain this positively, that the bottom is regularly covered over with beams. Split pieces of oak, 2½ inches thick, 9½ inches broad, and 3 feet long, are frequently met with: they have in the middle a hole about six inches in diameter, through which a pile has been driven in the lake bottom to hold the wood firm. The piles and beams lying about on the bottom are charred. The only other objects I have found showing traces of workmanship are a piece of stag's horn, some flint-flakes, &c. No actual stone implements have been met with.'

UEBERLINGER SEE. (EASTERN SHORE.)

THE stations about to be described, like those already noticed, discovered near Bodmann, are situated in the north-west arm of the lake of Constance, called the Ueberlinger See. (See Map, Plate XXVI.) They do not afford any fresh point of view as to the nature of lake dwellings in general, nor do they extend our knowledge of the manner of life and industrial abilities of the colonists. And yet their discovery and investigation form an important contribution to our knowledge of these localities; for while hitherto all that we knew about them seemed to bear out the assumption that the settlements in the north-east of Switzerland had been abandoned before, or almost immediately after, the introduction of metal implements, now we find amongst a number of settlements, exclusively belonging to the stone age, a station which was indeed founded and flourished at this period, but continued in existence till the new material, bronze, had come into use for all implements of domestic economy and the chase, as well as for objects used as ornaments.

With respect to the implements of the stone age found here, we do not find many new forms among those made of stone, bone, horn, or wood; they agree in general with those of other lake dwellings. If we see a difference in the materials made use of for the stone implements, this circumstance is easily explained by the peculiar varieties of stone employed by the settlers which came from the Rhætian High Alps. A greater variety of shape is seen in the pottery, and some forms are found here which have not been met with in any other locality.

If we examine the implements of the bronze age found here we shall find that not the slightest difference is to be seen between them and the implements met with in the lake dwellings of Western Switzerland, and we are led to believe that both came from the same foundry.

We have further to remark that, especially at Unter Uhldingen, a number of iron implements were discovered, which might appear to justify the opinion that this settlement lasted till the iron age; nay, even as late as the Roman and Allemannic dominion in these parts. But on carefully examining these objects, some of which are drawn on Plate XXVIII., it will be found that not a single specimen has been met with belonging to what is called the first iron age; consequently there is a complete gap between the end of the bronze age and the first century after Christ: the Roman period is only represented by some fragments of tiles, and all the other things date from the time of the Allemanni and the later centuries of the middle ages. It is not, therefore, proved that this station lasted till the iron age, still less can it be shown that it existed in the first century of our era: and we have the greater reason for doubting that the settlement was actually occupied at this period, as there is an entire dearth of all corresponding household and handicraft implements.

If we bear in mind how many implements of all kinds have, in the course of centuries, fallen to the bottom of the lake, partly by shipwreck, which must frequently have happened in early ages from the inferiority of the boats, and partly thrown away as refuse, especially in the neighbourhood of villages, we shall see that the greatest care is necessary in determining the age of specimens brought to light by excavations on the shores of the lakes.[1]

We are indebted for our knowledge of these settlements to Mr. Ullersberger and Dr. Lachmann of Ueberlingen, who have bestowed much care and attention on their discovery and investigation. Dr. Lachmann has described these stations very minutely; the following is the substance of his account:—

'Of all the settlements discovered within the last seven years in the lake of Constance, those of the north-western arm, called the Ueberlinger See, are the most important on account of their extent, and the number and beauty of the antiquities found there. That which increases the importance of these settlements still more, is the fact that not only are the antiquities of the stone age to which the other settlements in the lake of Constance belong represented here, but also those of the bronze age.

'Mr. Ullersberger of Ueberlingen, has for some years past investigated the settlements very carefully, and has preserved all the specimens in a regular collection.

'The immediate discovery of the lake dwellings arose from finding large quantities of flint: this mineral abounds in the Chalk formation,[1] but as the district of the lake of Constance is covered by "Molasse," flint is not found there naturally. Notwithstanding this, it is met with in such abundance in many localities on the shore of the Ueberlinger See, that the inhabitants have been accustomed from time immemorial to draw their supplies of flint from the shores of the lake without exhausting the store. The great abundance of this mineral, which had evidently been brought here by man, led Mr. Ullersberger to think that as flint was the material of the greatest importance to the ancient inhabitants, it was very probable that lake dwellings were to be found on the shores of the Ueberlinger See. He carefully examined all the available localities in the winter of 1862–3; the correctness of his supposition was proved, and since then he has collected the antiquities of the district with untiring energy.

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[1] Iron implements are found in stations like Sipplingen, and several on the western lakes, where not a single object of bronze has been met with, and also very commonly in places where there have been no lake dwellings. They are often found associated with roofing tiles in those lakes on the banks of which there were Roman stations.

'The available time for the investigation is however very limited, for the level of the water in the lake of Constance is subject to periodical changes, being highest in summer and lowest in the months of January and February. The highest known level was that of July 1817, which is therefore marked with O on the scale given in Plate XXVI. The lowest level known was in the winter of 1853–4, and is thirteen feet and a half under O: the medium water-level consequently is about seven feet under O. In December 1864, the level was eleven feet and a half under O. When the level of the water sinks thus in winter, and more especially in February, the investigation of the lake dwellings is greatly facilitated, as some of them are laid dry and they become easily accessible. In fact, the nature of the shore is such that at that time, even when the water has sunk only a few feet, a large extent becomes perfectly dry. For the Ueberlinger See partakes of the character of the whole eastern shore of the lake of Constance, along which a kind of terrace several hundred feet wide, consisting of beds of sandstone and clay, stretches out into the lake nearly horizontally, and then slopes suddenly down to the bottom of the lake. It is only in a few places, and particularly near the mouths of brooks or streams, that this bank is covered with stones, gravel, and sand. At low water it is for the most part dry and easily accessible; when the level is high it is often six feet or more under water.

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[1] It also occurs as 'flint,' 'hornstone,' 'chert,' 'chalcedony,' &c., in most limestones, whether soft and earthy, like Chalk, solid, like Portland stone, or hard and crystalline, like the Mountain limestone and other calcareous rocks of even older formations. Prof. T. Rupert Jones, F.R.S., on 'Flint'; *Reliquiæ Aquitanicæ*, p. 202.—[Tr.]

'On this terrace, which goes by the name of the "lake-slope," (Seehalde), there are the remains of five lake-dwellings on the eastern shore of the Ueberlinger See within the limits of a short three hours' walk; viz., the stations of the stone age of Nussdorf and Maurach, and those of the bronze age of Unter Uhldingen and Sipplingen. Plate XXVI. gives a little map of the district. The shore at these places rises more or less abruptly out of the lake, and is a fruitful, sunny, hill-country, covered with fields, meadows, forests, and vineyards, affording a charming distant view of the opposite shore and the Swiss mountains.

'The settlements of the stone age must first be described: they are situated near the shore, varying somewhat in distance from it: they were first seen when the water became low, and in consequence were the earliest discovered.

'I. *The lake dwelling of Nussdorf*, which was discovered in the winter of 1862-3, extends over a parallelogram of about three acres on the shallow shore, and exhibits some thousand piles in straight lines and at pretty regular distances apart. Though these piles have rotted off down to the lake bottom, and only a small number, when the water is low, appear above its surface, yet so many remain that we may be fully satisfied as to their nature and use. In general they are about two feet apart: sometimes several are found together, from three to six in number, but they seldom stand in pairs. The average circumference is one foot, but there are piles varying in this measurement from six inches to two feet. The wood of which they were made is of the kinds found in the neighbouring forests, viz., fir and oak. Generally they are made of whole stems; only a few are split. They are so much decayed that they can easily be broken in two by the pressure of the fingers. The part remaining in the ground is the best preserved, while that which, from the changes of level in the water, has been exposed to the influence of the atmosphere (or what sailors would call "wet and dry") has for the most part decayed away.

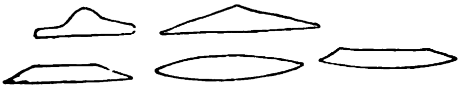
'Traces of fire are seen on many of the piles, a proof that the settlement was destroyed by a conflagration. The upper bed of the ground in which the piles were driven consists of about half a foot in thickness of rolled stones, gravel, and sand. Under this is found what is called the "relic bed," containing the antiquities, and consisting of organic remains, the stumps of piles, the refuse of feasts, &c. This bed is about nine inches thick. Then follows the blue clay of what is called the "lake-slope."

'The antiquities found at Nussdorf must now be described.

'*Flint Arrow and Lance Heads, Piercers, Knives, and Saws.*—Amongst the materials of the implements found at Nussdorf, flint takes the first place. Pieces in the rough and refuse of a black, and more rarely of a yellow colour, and varying in size from that of a small flake up to that of one's fist, are found really in countless numbers. The greatest pieces weigh about ¼ lb. On some of the specimens the chalky crust still remains.

'Nearly one hundred specimens of arrow and lance heads were found here; the shape in general is that of an acute-angled isosceles triangle, with the upper and lower surfaces more or less even (Plate XXVI. fig. *a*). There are, however, several variations from this normal form, of which we will only instance the following. Sixteen specimens had the lower side, or that opposite to the point, concave, fig. *b*; or this lower portion was continued in a projection varying in form, figs. *c*, *d*, *e*. The surfaces are either both alike, and even or somewhat curved, or only one side is arched while the other is flat, or the sides consist of two planes, so that there is an angle or ridge in the middle. The sections of these different varieties are shown below.

FIG. 14.



'The size varies from ½ an inch to nearly 3 inches, and there are all possible gradations between the two. The size, however, bears no particular relation to the shape, for specimens of similar size exhibit different forms, and *vice versa*. If the smaller specimens are called arrow-heads, and the larger ones lance-heads, we have found eighty of the former description and twenty of the latter. Sometimes they are admirably manufactured. In some cases they have been split so thin as to be quite translucent, at least at the edges. Those which have the kind of stalk or projection before referred to are the most highly finished, the best example of which is that drawn fig. *d*. We have only further to mention that of all these implements only two were of any other material than flint, viz. one arrow-head of serpentine, and one of translucent quartz.

'About eighty specimens of saws, piercers, and knives were found at Nussdorf; they are chiefly tongue-shaped, or like a spatula with the surface somewhat curved (Plate XXVII. fig.

13). They are pointed more or less at one end, and are blunt at the other (fig. 12). If the point is sharp, these implements somewhat resemble lance-points, but if rounded, they seem more like knives. The edges are serrated; most of them have the teeth sharper on one side than on the other (fig. 10). One of the surfaces is even and smooth, while on the other side there are one or two angles, and consequently two or three narrower planes lengthwise. The length varies from 1 inch to 7 inches; the breadth from half an inch to more than an inch and a quarter. Five rather long oval saw plates were made particularly well; they are from 3½ to 4¾ inches long, and from ¾ inch to 1¼ inch broad (Plate XXVII. fig. 14). One unique specimen has the form almost of a regular rectangle, with sharp corners; the side planes are quite even and smooth, and only one of the longer edges is serrated (fig. 20).

'The flint saws in general are 3½ inches long and 2 inches high; they are made of black or yellow flint. Eight specimens which were found set in wooden handles show us very satisfactorily how they were used. The handle is in the shape of a weaver's shuttle, made of yew-wood, and the saw is let in perhaps half its breadth and fastened with asphalt. The handle is perforated and very neatly made (Plate XXVIII. figs. 9 and 10).

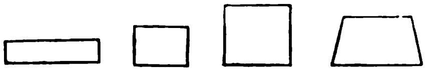
'*Wedge-shaped Implements* (*Celts, Chisels, Axes, Hammers, &c.*)—Implements of this description form by far the larger proportion of the whole collection. At Nussdorf alone about 1,000 specimens were found, chiefly in a good state of preservation.

'They appear to have been made partly out of the rolled stones found in the lake close by, and partly from materials brought from a distance. The collection contains nearly fifty celts made out of nephrite (probably a foreign mineral), and numerous specimens are met with made of serpentine, diorite, augite, epidote, decomposed green slate, basalt, porphyry, gneiss, &c.

'The shape of these implements, however much individual specimens may vary, may be traced up to the normal form of the hatchet, wedge, or celt, for each of them has five planes and nine angles. Four of the planes form the sides, the two opposite ones being similar; the two narrow side planes run to a point at the cutting edge; the two broader planes form this edge at their junction. The remaining plane, or that opposite to the cutting edge, is sometimes ground and sometimes left rough. The section in the middle is a rectangle. There are a number of variations from this normal form; in fact, this occurs to such an extent, that of the whole number of celts found, no two are alike; they may, however, be divided into two main classes, one containing the celts without a helve-hole, and which consequently had to be set in wooden clubs, the other including the celts with helve-holes, like our modern hatchets, into which wooden handles were fixed.

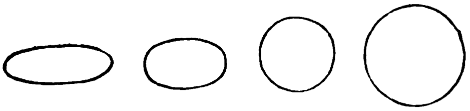
'The unperforated stone celts approach the nearest to the normal form. The section in the middle forms a rectangle, seldom a trapezium (Plate XXVII. figs. 3 and 7; Plate XXVIII. fig. 6).

FIG. 15.



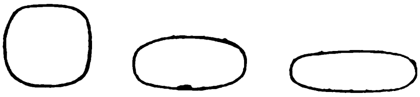
'If the side planes, however, are convex, and the corners at the sides blunted or rounded, the section in the middle forms an oval or a circle, and the specimens become cylindrical (Plate XXVII. figs. 1 and 2). Thus in section—

FIG. 16.



'Some specimens may be considered as transitions between these two classes; the side planes are convex, but the corners are not rounded off, so that the section becomes a rectangle made with curved lines, thus—

FIG. 17.



'These implements, however, cannot all be thus definitely divided into three classes; for many varieties exist between them. In Mr. Ullersberger's collection there are many specimens of which the section is an oval or a convex rectangle.

'Besides the forms just described, several implements have been found approaching very nearly the shape of a common chisel (Plate XXVII. figs. 18 and 21).

'The size varies as much as the form. Some of the unperforated celts have the following dimensions: length, 7⅓ inches; breadth, 2½ inches; circumference lengthwise, 15½ inches; circumference round the middle, 7 inches; weight, 2¼ lbs. On the other hand, the smallest specimens measure as follows:—length, ¾ inch; breadth, nearly ½ inch; circumference lengthwise, nearly 1¾ inch; circumference round the middle, rather more than an inch; weight, about half a drachm (Plate XXVII. fig. 9; Plate XXVIII. fig. 5). There are specimens of all sizes between these two extremes; in general, those with round or oval sections are larger than those where the section is angular.

'The cutting edge of these implements is almost always ground sharp, but there are cases in which the planes forming the edge meet at rather a wide angle, and in consequence each plane is again divided into two by a ridge (Plate XXVII. fig. 5). The side planes are either not ground at all or very little so, and in that case show more or less the natural fracture of the stone, or they are smooth like the cutting planes: the first case is more usual among the cylindrical celts, the latter amongst those which are wedge-shaped. We may mention as a specimen, unique of its kind, the small celt drawn Plate XXVII. fig. 6, which towards the upper end has a ring-like projection running round it.

'Several specimens found at Nussdorf show that some of the celts were hafted in the same manner as those of other stations. Three stone celts were met with fixed in the well-known handles or cases made of stag's horn, the upper part of which, the root of the horn, and the actual case of hafting, shows its natural surface: into this the celt was fixed and fastened with asphalt. The lower part of the stag's horn was cut into a rectangular form (Plate XXVII. figs. 16 and 19), in order to be fixed into a wooden club so as to be used as an axe. The complete implement, viz., club, hafting, and celt all united, has never yet been found on our shores, but specimens have been met with in other settlements. It may, however, be doubted whether all the unperforated celts were used with this artificial handle. The three celts which we found hafted belong to the smaller implements with the section rectangular. This fact, together with the enormous quantity of axes and celts, compared with the extremely small number of horn haftings, may justify the supposition that it was chiefly the smaller celts with angular corners which were fixed in this artificial hafting, while the larger implements with a round or oval section were actual tools in themselves, and needed no hafting. This hypothesis is supported by the consideration that one of these celts, ground to a sharp edge, weighing nearly 2 lbs., and well adapted to the hand, would not merely be a good tool but also a weapon.

'There is still another way of fastening the celt to the handle: a stock or branch, 1¼ or 1½ inch thick, was chosen, probably of hazel, with a root running from it at right angles. A cleft was then made in this shorter part, forming a kind of beak, in which the celt was fixed with cord and asphalt. Haftings of this kind are found not only in our district, but are also common at Wangen and Robenhausen (Plate XXVIII. fig. 24).

'The perforated celts, or those with a helve-hole, are much more rare than those of the other description. Amongst the large number of stone celts found here there were fifty with helve-holes, and only a few of these were perfect.

'Amongst the celts of this kind there are some specimens which have the axe-like form of the previous class (Plate XXVII. figs. 17, *a*, and *b*), and they have the same number of angles and planes. But while the unperforated celts become broader towards the cutting edge, these are more equal in breadth; sometimes, in fact, they become narrower towards the edge, so that the breadth of the two planes forming the cutting edge is very much smaller than that of the other two planes (Plate XXVII. fig. 4). One unique celt with a helve-hole exhibits a broad wing-like cutting edge (Fig. 23). The upper end, opposite to the edge, is either a plane with sharp angles, or it is rounded and convex. The helve-hole is either made in the middle of the implement (Fig. 22), or somewhat nearer the blunt end. The shape of the hole is either circular (Figs. 4, 17, and 22), or oval, as in Fig. 11. Sometimes there are two helve-holes, one behind the other; they are in that case either both round, or one is round while the other is oval (Fig. 24). In some specimens the celt is thicker or swells out where the hole is made. Sometimes in the unfinished celts two perforations may be seen begun at the opposite sides with the intention of meeting, and at the bottom of each hole there is a central projection, which proves that they were bored by a hollow tube-like instrument. (Compare Plate XXVIII. fig. 2, from Sipplingen with Plate II. fig. 6, from Meilen, see p. 25.)

'With respect to size, there is not the same difference between the largest and the smallest which is found in the unperforated celts. The length varies from nearly 3 inches to 7¾ inches; the breadth from 1¼ inch to nearly 3 inches, and the diameter of the helve-hole from ¾ inch to 1¼ inch.

'The workmanship indicates not only a considerable amount of skill in manipulation, but also a care for symmetry and elegance of form. All the surfaces are ground smooth, the angles are regular and sharp, the round and convex portions are perfectly well formed. On some specimens there are ornaments of engraved lines which commence on both sides of the helve-hole and converge towards the point (Plate XXVII. fig. 22), or a single line—a furrow—runs in the middle from the helve-hole towards the cutting-edge (Fig. 23).

'It is very evident that these implements had handles like our modern hammers, to which they bear a great resemblance; but whether they were used as tools or as battle-axes must remain doubtful. The small number of specimens of this kind, their fragile nature, their unimportant size, the labour bestowed on their manufacture, the ornaments which occasionally are found upon them—all these facts lead us rather to suppose that they may be considered as objects of ornament or distinction.

'Thirty specimens of what are called fruit-crushers and mealing-stones have been found here, twelve of which were round, and eighteen rather long in shape (similar to those from Meilen, see Plate II. figs. 8 and 11).

'Several stone implements were met with, the use of which is uncertain. Some of them are small flat plates or slabs, round or angular, and perforated, varying from about half an inch to an inch and a quarter in length, and from a quarter of an inch to more than three-quarters of an inch wide (Plate XXVIII. fig. 7); others again are rather long stones, somewhat in the shape of a cylinder, with a hollow running round the centre: they are from 1¼ to 2½ inches long, and from ¼ inch to ½ inch broad. Several specimens of this kind were found at Nussdorf. A little perforated plate of red sandstone, 2¼ inches long and 1½ inch broad, is drawn Plate XXVII. fig. 8; it is nearly rectangular, but thicker in the middle, and is perfectly blunt at both ends. And lastly, a stone, the shape of which is like half a stone hammer broken off at the haft-hole, but yet has the angles rounded; it has a furrow down the middle on each side. (Plate XXVII. fig. 15.)

'We will not venture to decide whether these perforated objects were strung on a string and worn as ornaments or amulets, but this seems probable from their being perforated; we must also leave it undecided whether the specimens with hollows running round them were merely objects in the process of working, or whether they were complete in themselves and were used for some purpose or other, as they are now found.

'The objects made of clay found at Nussdorf are very indifferent specimens of the potter's art, without any regularity, and rough on the outside; they were made with the hand alone, and hardened in the fire. The colour is dark grey, often black; the material is a grey loam mixed with small grains and pebbles.

'Only a few fragments of earthenware vessels were found; nothing perfect was met with. The thickness of these fragments varies from 1½ to 10 lines, but in some places they are thicker and in others thinner, for the curve is not uniformly maintained. Most of the specimens are simple and without ornaments, but on some of them there are irregular engraved lines or dots; others have parallel ridges or hollows running round the outside. The perfect vessels, judging from these fragments, seem to have varied in diameter from 2½ inches to 2 feet.

'Twenty-five spindle-whorls made of clay were found at Nussdorf in every respect similar to those found in other lake dwellings (those for example from Meilen, Plate III. fig. 13).

'Balls made of clay, coarsely worked and about the size of an orange, were found lately at Nussdorf in great numbers. They probably were used as weights for the loom.

'*Objects made of Organic Materials.*—A large number of specimens falling under this description were found at Nussdorf, not only the remains of animals and plants, but also the tools made out of them.

'The bones, horns, and teeth belonged to the following animals:—Horse, urus (*Bos primigenius*), marsh cow, stag (*Cervus elaphus*), roe, sheep, marsh pig, bear (*Ursus arctos*), dog, wolf, lynx, hedgehog, and beaver; remains of the pike and other fish were also met with. The bones are seldom found whole; a large number of the long bones had been opened lengthwise; the broad and short bones had been broken to pieces. On some specimens are still to be seen traces of the use of stone implements in the shape of notches and incisions. Some of the animals' skulls have a hole made in the parietal bone, probably to extract the brain. Amongst the more perfect specimens are several fine skulls and under-jaws of the marsh pig, the skull of a lynx (?), some lower jaws of the beaver (*Castor fiber*), hedgehog, &c.; also shoulder-blades, ribs, and tarsal bones of the marsh cow, some vertebræ of *Bos primigenius*, &c.

'The antlers and horns are also for the most part imperfect, though a few horns of the stag (*Cervus elaphus*), and also of the roe, were found whole; there were also rudimentary horns of these animals, and some horns of the marsh cow.

'A great number of teeth were found belonging to the horse, the boar, the dog, the stag, the bear, the beaver, the hedgehog, &c. The remains of plants are as abundant as those of animals. Hazel-nuts are very plentiful in the "relic-bed," most of them perfect; some apples were also found. Grains of corn, bread, &c., have not yet been met with.

'Seven hundred specimens of implements made from bones, horns, and teeth have been found here.

'Some bone implements were made out of the whole bones of small animals, and others out of splinters of those belonging to larger beasts. The bones of the extremities were chiefly used for this purpose, such as the radius, ulna, femur, tibia, and fibula; some were ground all over, and some only at one end.

'The little axes or celts of bone have in some measure the form of those made of stone, only they are thinner and more neatly manufactured. In some cases the two surfaces are even; in others they take the natural form of the piece of bone, and the tool then becomes more like a gouge. They are chiefly made out of the bones of the larger animals (Plate XXVIII. fig. 14).

'The chisels are rather long flat tools with a narrow but sharp edge; they are either broader at the handle than at the cutting edge—and in that case the head of the bone forms the handle—or they are of the same breadth throughout (Plate XXVIII. figs. 12 and 13).

'Netting-pins and hairpins were found in great numbers; they all have the point ground sharp. They are either made of the whole bones of one of the extremities, one end of which was ground to a point, or out of splinters of bone. The size varies greatly, from seven lines to ten inches (Plate XXVIII. fig. 11).

'Several bone implements were found, the use of which is unknown, such as cylindrical pieces of bone ground smooth and either perforated or solid; also implements some inches long, narrow, either cylindrical or flat, sometimes perforated or with a ring-like hollow towards one end (Plate XXVIII. figs. 18 and 23).

'The implements made of horns of the stag and roe, like those of bone, were used for all sorts of purposes: we have found awls, pins, cutting implements, little celts and chisels, all made of bone, and also similar objects to those of which the use is unknown. Together with these the following implements were met with:—

'Sixteen hammers, from 4¾ inches to 7 inches long and from 1¼ to 2⅓ inches broad; they are made out of the main branch of large stags' horns smoothed all over, and they have an oval or angular helve-hole. Part of the wooden handle was still remaining in one of these hammers (Plate XXVIII. figs. 20 and 21).

'Three combs were also found, made out of a flat piece of stag's horn (Plate XXVIII. fig. 8).[1]

'The teeth used for making implements were chiefly the corner teeth of the pig, the dog, and the bear: the molars were seldom applied to this purpose. Implements were sometimes made of whole teeth, but more frequently only portions were used, as, for instance, the outside of long teeth like boars' tusks. All the implements made out of teeth are neatly made, well polished, and in a good state of preservation; a few will now be enumerated.

'Netting, hair, or clothes pins, made out of boars' tusks and consequently curved; they have a sharp point, and are sometimes notched at one end, probably caused by the use to which they were applied (Plate XXVIII. figs. 16 and 17). The pins for making fishing nets were made out of the corner tooth of a bear, and perforated (Fig. 15). A fishing hook was found here made very neatly out of a boar's tusk: it is the second specimen of the kind which, to our knowledge, has been found in the lake dwellings. To make a hook of this kind the middle portion of a split boar's tusk had two large perforations made in it by a drill, and then the upper and intermediate part was scraped away; the remaining portion was easily made into a hook of the required form. (See the hook of this pattern from Moosseedorf, drawn Plate XXII. fig. 5.)

'We may consider as ornaments some canine and molar teeth of the dog (wolf?) with the fang perforated: they are too small to have been used as tools, besides which perforated teeth with two or three fangs could have been of no practical use. They were probably strung together and worn round the neck. Twenty teeth thus perforated have been found, of which sixteen were canine teeth and four were molars (Plate XXVIII. fig. 19).

'A little spoon-like implement was found lately, made out of a boar's tooth; it is the only one of its kind. The upper part, or what is called the crown of a tusk, has been hollowed out and rounded. The implement is neatly made.

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[1] At the meeting of the British Association at Birmingham, a number of specimens were exhibited which had been obtained from the recent excavations in Kent's Cavern, near Torquay, and amongst them a comb very similar to that above described.—[Tr.]

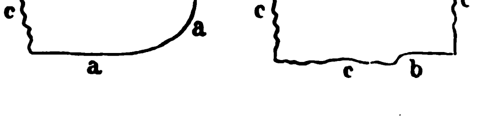
'The above are the whole of the implements found, and all of them are made either of stone or of organic materials. No copper, bronze, or iron has been met with, so that we may safely conclude that the lake dwelling of Nussdorf belongs to what is called the stone age.

'II. The lake dwelling of Maurach was also discovered in the winter of 1862–3. It is about half an hour's walk from Nussdorf. It extends over a long rectangle, containing about eight acres, and covered with many thousand piles. It comes close up to the shore, but stretches about 1,000 feet into the lake. Although this settlement is so very extensive, it is not rich in antiquities, nor has it, in fact, an actual "relic-bed," which may be ascribed to the fact that several years since a bank or dam was made here, so that not only the "relic-bed" was turned over and a mass of antiquities destroyed, but also the investigation of the place is very much impeded. Fortunately, however, so much remains standing that the size and character of the settlement can be distinctly made out.

'The piles are precisely the same in every respect as those of Nussdorf, and the same may be said of about 600 specimens of arrow- and lance-heads, saws, chisels, celts, hammers, &c., found here.

'There were also several unfinished axes or celts, and the stones out of which they were to be made, some of which had merely incisions made in them, or were partially hammered into shape. One of these specimens, taken from a rolled stone, is rather flat and of a roundish form, 8 inches long and 2½ inches thick; it has two furrows worked in it parallel with each other, about half an inch deep and an inch apart. Another stone has not only vertical but horizontal incisions. The sections of these two specimens are given in the following woodcut. In this section *a* represents the natural surface, *b* the incisions, and *c* the place where it had been intentionally broken.

FIG. 18.



'Some celts also were found in which the planes forming the cutting edge were very finely polished, and the edge was uncommonly sharp, while the other two planes were very little ground and showed traces of the original sawing.

'The mode of manufacturing celts has been before described: the stones were first sawn partly through, then broken, then partially hammered into shape, and lastly ground to the required form.

'A careful search was made for pottery, but no specimens were found, and the same remark will apply to the remains of plants and animals as well as to implements made out of these materials—a circumstance which may probably be explained by the destruction of the relic-bed.

'On the other hand, a perforated flattened bead of amber was found, more than an inch high and nearly an inch and a half broad; the amber is opaque, clouded yellow, with whitish veins and spots.

'The only object of metal found at Maurach was the anterior part of a *copper* axe or celt.

'In spite of this copper implement, we must consider Maurach as a settlement of the stone age; for the remainder of the antiquities, the nature of the erection, its situation on the shore, &c., perfectly agree with the stone station of Nussdorf, while the bronze lake dwellings of Unter Uhldingen and Sipplingen exhibit very different features from those of these stone age stations. Besides which, this single object of metal may have been brought to Maurach by accident.

'The bronze and iron stations differ from those of the stone age not merely because, together with implements of the stone period, those of bronze and iron are found in them, but also because they are situated at a greater distance from the shore, and consequently in much deeper water, so that even at the lowest level they are never exposed above the surface. Besides this, the piles are fastened together with cross beams, and the whole structures were strengthened by stones heaped together, so that they actually stood upon "steinbergs" or hillocks of stones. The implements also are more perfect than those of the stone age. The following bronze and iron stations have been found on our lake shores:—

'I. The lake dwellings of Unter Uhldingen, which were discovered late in the year 1864, are situated near the village of that name, about an hour and a half's walk from Ueberlingen, nearly half-way between that place and Meersburg. There are two settlements, lying about 1,000 feet from the shore, and at a distance apart equal to a quarter of an hour's walk on land. One of them is on three, the other on four stone hillocks, about four or five feet high and made of rolled stones intentionally heaped together. When the water is low the summits appear above the surface; when the water is high they are eight or ten feet below it. Each of the settlements extends over eight or ten acres, and the number of piles may probably be 10,000; they are of greater diameter than those of Nussdorf and Maurach, but in other respects they are similar.

'It may also be noted as peculiar, that at the bottom of the lake, between the individual piles there are cross-beams, some of them still in good preservation, which have probably been used for binding the piles together, and thus strengthening the substructure. As the foundation on which the whole stands is a hillock of stones, there can of course be no actual "relic-bed;" the antiquities lie between and on the masses of stone, and correspond with the improved mode of erection, for besides the objects of stone and clay usually met with in the settlements of the stone age, we find here well-made tools and weapons of bronze and iron.

'But few words will be necessary as to the stone implements found here: they have in general the same character as those of Nussdorf and Maurach. They consist of the following objects:—Arrow- and lance-heads. Flint saws, one of which is nine and a half inches long. Three hundred celts, chisels, and axes without helve-holes; some specimens are a foot long; a few were found with helve-holes, one of which is neat and well-made, and might be used also as a hammer (Plate XXVIII. fig. 1). Two unfinished stone hammers, which have the usual form of those which are perforated, but yet there is no hole through them. All these implements, of the shape of a wedge, were precisely of the same kind of material as the celts of Nussdorf and Maurach; and the same may be said of the "fruit-crushers," mealing-stones, and grinding-stones, the net-sinkers, little flat perforated discs of limestone, stone hammers formed like a club, implements like a bar or staff, and some other objects of peculiar form, the use of which is unknown.

'The objects made out of clay are in general better formed than those of the stone age settlements.

'Forty spindle-whorls were found here, somewhat larger than those from Nussdorf and Maurach.

'Pottery is met with very abundantly, but unfortunately chiefly in fragments. A hundred and thirty pieces were found, each differing essentially from one another in material, form, ornamentation, size, and hardness. As far as we can judge from the specimens, there was the greatest variety of shape, so that we may mention dishes, cups, jars, vases, crucibles, covers, vessels with handles, &c. Many of them had a very small base and a very large bulge. Some of the vessels which are perfect, and which very much resemble our modern plates, have the peculiarity of being ornamented, not outside, but inside, within the cavity, with designs either in relief or engraved (Plate XXX. figs. 4, 5, 6). Some of the vessels are plain and some ornamented; in the latter case the designs are either indented or in relief, and consist of points or lines, the latter forming figures, such as triangles, &c. Annular and spiral ornaments are also met with. In some cases a great deal of taste is displayed in the ornamentation (Plate XXX. figs. 4 and 7). The size varies greatly, some of the vessels being only two and a quarter inches, while others are upwards of two feet in height. The larger proportion have been well burnt.

'We will select for illustration a few of the perfect vessels. Four bowls, one with a handle; two vases; two flat or broad vessels, contracted above so as almost to form a kind of neck, Plate XXXI. figs. 2 and 3. Two cups, Plate XXX. figs. 8 and 9. A crucible, Plate XXXI. fig. 6. Two ornamented covers, Plate XXX. fig. 2, and Plate XXXI. fig. 1. Besides the above, some pottery was found of pretty red clay (*terra sigillata*), which was of Roman origin.

'Together with the implements we have mentioned, made of stone and clay, there were found a large number of bronze tools and weapons, which undoubtedly prove that bronze was both manufactured and used on the shores of the lake of Constance in prehistoric times. These objects were all cast evidently by good workmen, and they are ornamented like all the other implements of the bronze age. The following specimens may be especially mentioned:—Six lance-points (Plate XXXII. figs. 14, 15, and 16). A number of celts, some of them with ridges for the shaft (Plate XXIX. fig. 20, and Plate CXXXIX. fig. 4), and sixteen specimens with flanges made for wrapping over it, some of which are from the same mould. One of the bronze celts found here is peculiar, as it has the shaft flanges not at right angles to the plane of the cutting edge, but in a line with it (Plate XXVIII. fig. 30): a similar arrangement has been previously described. Two socketed celts (Plate XXIX. fig. 26), and two implements like chisels (Fig. 25). Twenty-five knife-blades, chiefly in a good state of preservation, and ornamented; some, however, are a little damaged (Plate XXXII. figs. 1 to 13). Sickles like that drawn Plate XXIX. fig. 23. Fish-hooks, one of which is very large (Plate XXIX. figs. 21 and 22). Eight bronze rings. Four armlets, some of them beautifully ornamented (Plate XXIX. figs. 1, 2, and 24). More than a hundred pins of different sizes; the heads are ornamented with considerable taste: they were probably used as clothes or hair-pins, or for sewing or netting (Plate XXIX. figs. 3 to 18). A pair of compasses of bronze: it is uncertain whether this specimen is of the same age as the other bronze implements.

'Several iron implements were found at Unter Uhldingen; the following are some of the most interesting:—One lance-head, and five arrow-heads, like those of bronze (Plate XXVIII. figs. 26 and 27). One axe or celt. Two tools like carpenters' chisels. Twelve knife-blades, in fact nine like our common knives, of which one has a handle, the end of which is formed by a knob of bronze. Two sickle-like vine-pruning knives (Plate XXVIII. fig. 25). Also a dagger-shaped knife; an iron ring; a long triangular plate of iron with a ring at one end (steel for striking a light?) (Plate XXVIII. fig. 29). A fibula; a clothes-pin. The remains of an iron two-edged blade; also a short iron sword with a wooden hilt, in a good state of preservation. An iron stamp. Two perforated pieces of iron; a two-pronged iron tool like a fork; a pair of pincers (probably tools used in the foundry).

'The objects made of glass found here are eleven bottoms of goblets, and one smooth glass slab; these things seem to belong to a later age.

'Neither tools, weapons, nor, in fact, any other objects made out of organic material, have as yet been found here. While in other stations a number of tools, such as pins, haftings, and hammers, have been met with, all made out of bone or horn, not a single specimen of the kind has hitherto been found at Unter Uhldingen. On the other hand, bones, teeth, and horns unworked occurred here; in fact, of the same species of animals as are found at Nussdorf and Maurach. We may also mention some vertebræ of *Bos primigenius*, determined by Dr. Ecker of Freiburg.

'II. The lake dwellings of Sipplingen, which were discovered in the winter of 1864–5, are situated on the shore of the village of Sipplingen, about an hour's walk north-west of Ueberlingen. They probably extend over twenty-three acres, and the number of piles may be 40,000 or 50,000. The distance from shore is from 1,200 to 1,500 feet. These settlements are in every respect like those of Unter Uhldingen, but the masses of stone are so much scattered that they cannot be divided into separate hillocks.

'The following are the specimens found here:—

'The objects made out of stone agree exactly with those of Unter Uhldingen. We may, however, especially mention ten flint arrow- and lance-heads, one of which is very large (Plate XXVIII. fig. 33). A flint saw-plate like that found at Nussdorf and drawn Plate XXVII. fig. 20. With these flint implements a great lance-head of serpentine was found: it is drawn Plate XXVIII. fig. 3. Two hundred specimens of unperforated stone celts were found here, amongst them some specimens as large as those of Unter Uhldingen; two of them were hafted in stag's horn. Twenty perforated stone hammers, some perfect, others imperfect. One specimen of an unfinished hammer deserves mention: the helve-hole is not bored through, but it has been drilled on both sides about a quarter of the thickness. A projection remains standing in the middle of each hollow (Plate XXVIII. fig. 2). It is evident from this that the hammers were not drilled till after they had been formed into shape. We may also mention eight specimens like chisels (nephrite ?).

'As usual, corn-crushers, hurling-stones, net-sinkers, mealing-stones, and grinding-stones were met with, as in other stations.

'A hundred specimens of stone implements, the use of which has not been decided, were found together in a heap. They are stones artificially worked into the shape of a cylinder, a plug, or an egg; they are rather long, ground and rounded off without corners or angles, and one end is generally broader than the other. We cannot make out with certainty the use to which they were applied, but, according to our own ideas, they are unfinished stone celts, which they resemble both in size and shape. If the broader end were ground down to a cutting edge, they would become the regular stone celts. If this view be correct, we gain a further hint how the celts were made, for the cutting edge would not be made till the stone had received the general form of the implement (Plate XXVIII. fig. 4).

'The objects made of clay are in general like those of

Unter Uhldingen. The following may be mentioned as good and perfect specimens. Two jars with handles (Plate XXX. figs. 11 and 12). Some dishes or pipkins (Fig. 13 and Plate XXXI. fig. 4), amongst which is one with the base formed of a flat circular projecting portion, Fig. 8. Several cups or bowls, Fig. 7. Some vases (Plate XXX. figs. 1 and 10): also a wide funnel-shaped vessel (Fig. 14), and a large kind of jar with the base perforated like a cieve (Plate XXXI. fig. 5), and a crucible. In some of the vessels there were the remains of plants, which are not to be considered as the relics of food, but rather the chance lake-weeds which had got into them. Besides these vessels, which were brought up in a more or less perfect state, forty fragments of pottery were secured, also some net-sinkers made of clay, and a mould, and, lastly, some specimens of earthenware, the use of which has not at present been determined (Plate XXX. fig. 3).[1]

'No bronze implements have as yet been found at Sipplingen. One single celt was met with made of copper, of very simple form like that of the stone celts; it has neither flanges nor ridges for the shaft. It was found embedded in a coating of clay (mould?) (Plate XXIX. fig. 19).

'The iron implements of this settlement consist of one lance-point, three arrow-heads, two sickles, one one-edged sword, two pieces of iron of a cylindrical shape, and one Roman key (Plate XXVIII. fig. 28).

'Five pieces of grey-coloured glass were found here, all covered with little wart-like projections.

'Bones, horns, and teeth occurred here as at Unter Uhldingen; also vertebræ, and very perfect horns of *Bos primigenius*. A human parietal bone is a rarity in the settlements of the lake of Constance.

'Sipplingen is rich in implements made of horn and teeth: we may mention an arrow-head of stag's horn. Eighteen ground four-sided stag's horn haftings; only a few of them were perfect (Plate XXVII. fig. 16). Eight similar haftings, but with the root or lower part cut into two prongs (Plate XXVIII. fig. 22). Twelve stag's horn haftings of a cylindrical shape. Eight pieces of stag's horn hollowed out to make haftings. Five bone pins. One hammer of stag's horn. One perforated bear's tooth, like those found at Nussdorf. Lastly, some implements of stag's horn ground to a point.

'The whole of the antiquities above described have been bought by the Würtemberg Government, and are now in the Museum at Stuttgart.

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[1] May not this have been one of the supports for pipkins on the fire?—[Tr.]

'TABLE I. COMPARATIVE VIEW OF THE LAKE DWELLINGS ON THE EASTERN SHORE OF THE UEBERLINGER SEE.

	Nussdorf	Maurach	Unter Uhldingen	Sipplingen
Time of discovery .	Winter 1862-3	Winter 1862-3	Late in 1864	Winter 1864-5
Area in acres . .	3	8	10	25
Number of piles .	3,000	5,000	10,000	40,000
Distance from shore .	50 feet	10 feet	1,000 feet	1,500 feet
Nature of the ground	Sand and clay relic-bed	Clay relic-bed destroyed	Sand and clay 'steinbergs'	Relic-bed wanting
Materials of the antiquities .	Stone, clay, bone, horn, and teeth.	Stone, bone, horn, teeth, amber, copper.	Stone, clay, bronze, iron, glass.	Stone, clay, bone, horns, teeth, copper, iron, glass.

'TABLE II. NUMBER OF ANTIQUITIES FOUND (AT A ROUGH ESTIMATE).

Specimens made of	Nussdorf	Maurach	Unter Uhldingen	Sipplingen	Total	Remarks
Stone . . .	1,100	500	400	350	2,350	The majority ($\frac{5}{8}$) wedge-shaped celts. 400 imperfect specimens.
Bronze . . .	—	—	200	—	200	
Copper . .	—	1	—	1	2	
Iron .	—	—	40	16	56	
Glass .	—	—	40	8	48	
Clay . .	40	—	180	60	280	Greater part ($\frac{2}{3}$) are in fragments.
Amber .	—	1	—	—	1	
Organic material	700	—	—	100	800	
Number of specimens found in the different settlements .	1,840	502	860	535	3,737	

'Ueberlingen: December 1865.'

After the above report was written, the weather during the rest of the winter was extremely favourable, and the level of the water in the Ueberlinger See more than usually low, so that very many antiquities were obtained from the various settlements in this lake.

LAKE OF ZUG.

FOUR, if not six, lake dwellings are now known on the banks of this lake. We will first give an account of the one found near the town of this name.

I. ZUG.

The discovery of the settlement, to the north of the town of Zug, was made by Professor Mühlberg, and it is of peculiar interest, as it has an especial bearing on the primæval history of the interior cantons of Switzerland. The view was formerly entertained that no trace of any permanent settlement in prehistoric times was to be found in these valleys; no Celtic settlements, and no graves or tumuli of this period have hitherto been discovered in this district, but only some chance stone and bronze implements, so that the only indications remaining of an earlier population were, till lately, the names of a number of places and mountains quite identical with some in the Rhætian valleys (Grisons and Tyrol). This led to the supposition that at some former period Rhætian races inhabited the whole mountainous district of the Alps; and now the very early existence of the human race in the inner parts of Switzerland is proved to a certainty by the discovery of a settlement which is exactly of the same nature as the lake dwellings of the stone age discovered in the lower parts of Switzerland.

The report given by Professor Mühlberg is in substance as follows. At the farther end of the upper row of houses in the suburb of Zug towards Cham, on the site of the modern hotel called the Keltenhof, Mr. Brandenberg, in excavating for the foundations of a new building, came, at a depth of about five feet, upon a black bed of decayed organic matter. Nearly at the top of it he found two stone implements, and also the perfect lower jaw of a marsh-boar. Attention was immediately directed to the place, and when the former existence of a lake dwelling on this spot was proved, arrangements were made for preserving every object of interest, and funds for carrying out the exploration were granted by the town-council. The collection, now in the college, is by no means unimportant; it may be classed under three heads: remains of plants, of animals, and of stone.

Amongst the vegetable remains, the piles found here take the first place. They are from three to five inches in diameter and from three to five feet in length, and consist of different kinds of wood. Those of the hard brown oak are still in fair preservation, and tolerably hard; the majority, however, of the piles are of fir-wood, and are very soft and spongy, offering no obstacle to the use of the spade, and often quite penetrated by the roots of water-plants. As the piles are round or unhewn, and for the most part still have the bark on, it is easy to distinguish those of alder, willow, birch, and hazel. Some of the piles were quite perfect, and it appears from them that the lower ends had been sharpened by means of fire. The piles reached down to, and had been driven into, a whitish granular strong muddy mass, probably the ancient bed of the lake; the upper parts went through a peculiar black bed, from seven to ten inches thick, consisting of nothing but decayed animal remains and plants, especially twigs and leaves. The heads of the piles were all on a level, and in some places they still had the horizontal beams lying upon them, consisting partly of natural stems, and partly of trunks of oak or fir split in two. The black bed was the locality where all the antiquities were found. There was a large quantity of charcoal, proving that the settlement was destroyed by fire. Great quantities of hazel-nuts, chiefly cracked, were discovered, also beech-nuts and applecores, but no grains of corn or flax.

Only the most perfect of the animal remains were kept—numbers of broken bones of the extremities were thrown away; most of them, as well as the remains of vegetable food before mentioned, were found heaped together in one place—a voucher for the fact, already proved in other settlements, that these remains are nothing else but the refuse from the kitchens of the lake colonies. The bones, jaws, and teeth belong chiefly to the red deer, the marsh swine, and the marsh cow. Remains of the roe, the horse, the domestic dog, and probably also of the sheep or goat, were also met with.

With respect to the stone implements, they consist of two very different kinds of material. A few lance points and one knife were of flint. It may not be out of place here to mention (though not actually found in the lake dwelling) that in 1843 a flint arrow-head with its wooden shaft was found on the Zug mountain in what is called the Moor of Geissboden; it may probably date from the time of the lake dwellings.[1] The greater number of the implements, however, consist of serpentine; many well-ground celts of this material were found, and many less finished or fragments, as well as the raw material in different stages of working. It is very clear from these specimens that the stones were sawn half through with another hard sharp stone and then broken, and the fragments thus obtained could afterwards readily be ground to the required form (see Plate XXI. fig. 5). One fragment ought to be mentioned: it is that of a small celt, and consists of a clear green stone (nephrite?).

No implements of bronze or iron were discovered, nor any pottery.

From what has been said, this lake dwelling apparently belongs to the stone age; but this cannot yet be affirmed with positive certainty, for only a small portion of the settlement has been uncovered or could be examined. It clearly extends for a considerable distance in some directions, for what evidently was a continuation of it was found some years since (before attention was particularly called to the subject) about 100 paces farther towards Cham on one side and also 100 paces towards the town on the other, and celts of serpentine were found in these localities. Subsequent investigations, however, seem to show that it has not extended farther landwards.

Professor Mühlberg calls attention to one stone implement differing essentially from the others in being of a yellowish white colour and in being less hard; he considers this celt to be of serpentine altered by heat; and with a view of testing this opinion he exposed in his laboratory a fragment of the raw material used for celts to a strong heat for a length of time. Before the experiment it was dark-green and as hard as fluor-spar, but afterwards it became of a dirty yellowish colour, friable and soft. Consequently this is another proof that the lake dwelling at Zug was destroyed by fire.

The Professor's report then proceeds to give some particulars as to the nature of the ground where the lake dwelling was found. The space excavated was 40 feet long and 30 feet broad. It is on the right hand of the road leading to Cham, and close to it. (See Plan, Plate XXI. fig. 2, *a*.) This road is about 50 feet distant from the lake, and is 15 feet higher than the level of the water. The excavation is 5 feet deep in front but 6 feet behind, as the ground rises toward Baar. (See Section, Plate XXI. fig. 1.) Four different beds may be distinguished; the upper one is of common mould 2½ feet thick, under which there is a bed of sand and rolled stones 1½ foot thick, followed by the 'relic bed' very distinctly marked and from 8 inches to a foot in thickness. It is in this bed that the piles are found, but their lower ends go deeply into the fourth or lowest bed, which very probably is to be considered as the ancient bed of the lake, as it contains numerous shells of the small lake snails and also of the bivalve freshwater mussel. All these beds are inclined about three degrees towards the lake. It may thus be considered certain that in ancient times this settlement stood in the lake, or, to speak more correctly, that the lake extended formerly, as tradition says, much farther inland than at present. The fact of the present shore being so distant from the locality where these remains were found, may be explained partly by the bed or outlet of the river Lorze at Cham having been several times deepened, which of course lowered the level of the water in the lake, and partly by the great deposits on the plain of Baar brought down by the mountain torrents, and chiefly by the Lorze itself. This supposition is confirmed by the great fall of the Lorze from Ægeri to Baar (nearly 1,000 feet), and by the general agreement of the gravel brought down with the mass of stones in the deep gorge above Baar called Lorzetobel. Yet nothing is known of any diluvial action on so great a scale either in historic times or by tradition.

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[1] Of this arrow-head with part of the attached shaft two views are given, Plate XXXIX. fig. 15. The mode of attachment is well shown. The flint arrow-head is precisely like those found in the lake dwellings.

The animal remains were sent to Professor Rütimeyer for examination. He reported that some few of the bones entirely differed in colour and condition from the others, and ought to be left out of the calculation, being probably chance additions. The remainder, though decidedly of interest by enabling us to draw in some measure a parallel with other localities, were, he considered, too small in number to warrant a general conclusion as to the fauna at the time of this lake settlement.

He states that the bones sent to him belong to the following animals, and he arranges the list under numbers, the earlier of which indicate those species found more plentifully in the small collection.

1. Cow. These remains belong entirely to the small do-

mestic animal hitherto found as the prevailing form in every lake dwelling, and which is called by Professor Rütimeyer the marsh cow, and considered by him as the original stock of the grey or brown race of cows, chiefly of small size, now spread through the whole chain of the Alps. The perfect metatarsal and metacarpal bones leave no doubt about this. The underjaws are of less value, as they belong to young animals and still contain the milk teeth. 2. Red deer, not different from those of the present day. 3. Marsh swine. All the specimens of swine's bones belong without doubt to the small race called by Professor Rütimeyer the marsh swine, the size of which was decidedly less than that of the wild boar of the present day, and which in many other respects also differs from it. The remains of this animal gave the Professor the impression that it was in a wild state, but the small number of specimens would not allow of any certain decision on this point.

There is only one single bone of each of the other species. 4. Roebuck. 5. Horse. 6. Domestic dog: only a piece of the radius, which affords but small ground for determination; but as far as size is concerned it does not differ from the race exclusively found in the dwellings of the stone age designated by Professor Rütimeyer the marsh dog. 7. Hare. It is uncertain whether the upper part of the femur found here really is of the age of the lake dwelling, as its colour is unlike that of the other bones, and it has a more recent appearance. Till lately, no remains of the hare have ever been met with, and more accurate information as to where this little piece was found would be highly desirable. Lastly, some remains of the pig and the sheep have quite a recent appearance.

Professor Rütimeyer concludes his report on these animal remains nearly in the following words:—'You will see from this short list that it is very far from affording anything like a safe comparison with that of other lake dwellings. The most important point in it, is the positive determination of the marsh swine: it is much to be desired that further remains of this animal may be found, which would enable us to determine with certainty whether it belonged to the wild or the domestic animal; and further excavations would doubtless be of great importance on account of the excellent state of preservation of the bones, for in so small a number I have never seen so many perfect ones, or at least so many that were but little damaged. In the meantime, I must recur to my first view, which leads me to place the age of this settlement as coinciding with those of Wauwyl and Robenhausen, unless, indeed, future discoveries modify this opinion; but probably the additional evidence of the artificial products leaves no doubt on the point.

Plate XXI. fig. 1 gives a section of the locality excavated in the lake dwelling of Zug; Fig. 2 shows the ground plan; Fig. 3, celt of serpentine; Fig. 5 is a piece of serpentine partially sawn through in two places, preparatory to being made into three celts; Fig. 4 is a flint arrow-head.

II. KOLLER.

In the summer of 1863, Mr. Schwerzmann of Zug, when making a ditch alongside of the line of the railway, noticed fragments of pottery which were thrown out with the earth; Mr. Staub, the Prefect, to whom he mentioned this fact, went several times to the place, and 'I accompanied him,' says Professor Mühlberg, 'to aid in the search for antiquities.' The locality is close to the line of railway from Zug to Cham, in fact, within the triangle made in the low ground west of the Lorze by the lines of the Zurich, Zug, and Lucerne railways. We examined the ditch, and made a small excavation, and we were rewarded by a whole basketful of fragments of pottery made of fine grey clay, but badly burnt; with a single exception, they were all portions of vessels with a great bulge. No tools of stone or metal were met with, except some bits of waste celts of serpentine. We also found charcoal, hazel-nuts, and some bones. The relic-bed is not thick. The following is the succession of the various deposits: at the top the marshy ground is half a foot thick; then comes loam or clay 2½ feet in thickness. Below this is the relic-bed, the thickness of which is uncertain, lying upon the white lake bottom or shell-marl. It is in this last bed that the piles are found standing here and there, and on these rest cross-timbers of oak. From the small extent of our excavation it was impossible to determine exactly the arrangement and distribution of the piles, yet so far seems certain, that the piles run parallel with the shore. If excavations were made within the above-mentioned triangle, and no remains were discovered there, it would be proved that the settlement extended from the south line of railway down to the lake. It may be remarked that the present level of the water is three feet under that of the relic-bed.

III. ST. ANDREAS NEAR CHAM.

The picturesque little castle of St. Andreas is situated on a small rise east of Cham, near the lake. Not far from it, in a north-easterly direction, the countrymen, when tilling their lands in the low grounds, had for some time past found stones ground into the shape of hatchets, but after exciting a little wonder they had always been thrown away. In consequence, however, of the discovery of the lake dwelling at Zug, these stones began to be regarded with more attention, and were preserved when found. When these facts came to the knowledge of Mr. Staub and myself, we went over to the locality in the summer of 1863, and were fortunate enough, when simply walking over the fields, to fill our pockets with as many stone celts as we could carry home. A short time afterwards the owner of the property sent to Mr. Staub, who is the prefect of the place, a whole basketful of stone celts. This discovery incited us to excavate in the following autumn. A trench was made from the lake nearly to the line of the railway, and also a smaller trench at right angles. The result, however, was not of much importance. All that we obtained from the excavation consisted of a few stone celts and the positive proof of the existence of piles; they were from three and a half to six inches in diameter, but were not very numerous. We found no piles in the lower part of the trench, and we consequently concluded that the settlement did not extend to the present bank of the lake, but probably went farther landwards from the place which we excavated. The shell-marl or the ancient lake bottom was here only half a foot beneath the surface. No actual relic-bed was to be seen; or, to speak more correctly, the tillage-ground, half a foot thick, was the ancient relic-bed. The celts which were in the bed above the shell-marl were brought to light by the plough or by digging up the produce of the land, while pottery was destroyed, and everything else which was very fragile. The specimens found at this station were consequently only piles and stone implements.

The stone implements found here may be divided into three classes, according to their shape and material.

1. Implements made of erratic pebbles and blocks. By far the greater number of the implements found here belong to this class. They are celts of various forms and sizes from ½ inch to 2⅓ inches broad, from 1½ line to 2⅓ inches thick, the shape

being either triangular, long quadrangular, or elliptical, and the section being either rectangular or elliptical. All of them were ground sharp at one end, while the other is either truncated or rounded off in a conical form. In every case the workmanship is rude. While all the celts from the lake dwelling at Zug were carefully rubbed down and smoothed on every side, those found here were only polished on the surface of the cutting edge. The material was taken from some of the numerous erratic blocks lying about, and consequently their composition is just as varied. In general, the kinds of stone which are of the nature of limestone, or coarse-grained varieties of granite and gneiss, were rejected, and those were chosen in preference which are fine-grained, compact, and hard, and of a siliceous nature. Some specimens, however, were met with of very coarse gneiss, containing a quantity of epidote, which naturally could neither be well worked nor brought to a fine edge. Very many consist of a kind of serpentine, which does not occur in erratic blocks in the canton of Zug, and these specimens were the best both in shape and workmanship. One single celt reminds us of the nature of what is called the Julier granite, and we are tempted to believe that the material out of which it was made was brought from the Julier pass or from the Grisons, and that the serpentine out of which the other celts were manufactured came from the same district. Another specimen consists of talco-quartzite, of which numerous blocks are to be found in the eastern part of the canton, being in fact erratics from the canton of Glarus. The erratics of the plain brought down by the glaciers of the valley of the Reuss, are of the kinds of stone found *in situ* in the canton of Uri, and the material of the celts so completely agrees with them that we may often fancy the block may be recognised from which this or that specimen was struck off.

2. Implements of flint. The fragment of a lance-head, and also many waste flakes of the same material.

3. Implements of limestone (Plate XXII. figs. 13 and 14). These tools are rather long and flat, with a short neck, perforated for the sake of being worn or hung up. In one specimen (Fig. 14), after the handle had been broken off near the hole, a second perforation was made, and it was again used, notwithstanding its being imperfect—a proof that the thing was of some importance either as an ornament or an amulet.

IV. DERSCHBACH.

Having repeatedly heard that stone celts had been found between Buonas and Cham, on the west side of the lake of Zug, I examined the flat shore of that neighbourhood, and actually found a stone celt on the foot-road leading from the houses of Derschbach to the fishermen's huts on the bank of the lake. We may therefore safely assume that a lake dwelling existed here; but it can only be thoroughly examined by means of an excavation.

V. AND VI. ZWEIEREN AND AT THE BATHING PLACE AT ZUG.

These two localities have been mentioned to me incidentally as lake dwellings, and I have no reason to doubt the correctness of this information.

In conclusion, I would call attention to the interesting fact, that all the lake dwellings hitherto discovered on the lake of Zug are situated somewhat inland. On this account it has been supposed that they stood originally not in, but on the banks of the lake. This view, however, is shown to be incorrect, as the relic-bed everywhere rests upon shell-marl (Seekreide); we must therefore conclude, as I have previously mentioned, that the level of the lake in early ages was considerably higher than at present, and that the water in those times extended so far over the present land as to cause the modern shore to be covered to some depth with the waters of the lake. The lake dwelling of Cham is a proof of the correctness of this view, as the lower part of it does not extend to the present shore. Apparently the lake was lowered by the deepening of the channel of the river Lorze, which flows out of it. The relic-beds of the different settlements in consequence lie on dry ground, and are found under a thin covering of vegetable mould, or of gravel brought down by the mountain streams.

Plate XXII. figs. 2 and 3. Vessels found at Zug of a gray colour, made of purified clay. The shape of Fig. 2, and the 'meander' pattern on Fig. 3, indicate a later period and more advanced civilisation; they do not belong to the actual stone period, but to the bronze age.

NIDAU-STEINBERG.

This station was the earliest of its kind which was investigated, and it deserves especial attention, not only on this account, but from the mixed character of the antiquities found here, which belong to the stone, the bronze, and even the iron age.

The name of Steinberg has from olden time been borne by a shallow in the lake of Bienne some hundred feet distant from the place where the river Zihl flows out of the lake by several channels. The depth of this lake at its lower or north-western part, when the water is of an average height, does not exceed 18 or 20 feet; and the Steinberg is a hillock rising gradually from the bottom. Its superficial area is about 2½ or 3½ acres; its actual summit is usually covered with 7 or 8 feet of water. On the south side, towards Nidau, the lake is of less depth than elsewhere in the shallow parts, so that the Steinberg is connected with the shore by an elevation of the lake bottom like a dam or bank. (See Plate XL. fig. 1.)

Steinberg takes its name from the fact that while the bottom of the lake is almost everywhere covered with mud and loam several feet thick, this hillock consists of an accumulation of roundish stones. A closer examination of these stones shows that they are rounded water-worn stones, very nearly all of the same size, and consisting of quartz and granite; these erratics are not in their original bed, but have evidently been collected with great care and labour from the heights above Nidau, where similar stones are found in profusion, and have been brought in boats to this part of the lake. This fact, which when Nidau-Steinberg was first examined appeared a singular assertion, is confirmed by what was found at the Island of St. Peter, which will be described in its proper place, as well as by the numerous instances of lake dwellings lately discovered, very many of which are placed on a Steinberg or stony hillock of similar construction under water.

As we have proof that the low ground below Nidau, together with that between the lakes of Bienne, Neuchâtel, and Murten, called the 'Great Moss,' was in former times inhabited, and the level of these lakes in early ages was considerably lower than at present, it is in the highest degree probable that the upper part of the Steinberg was once very near the surface of the water, if it did not even rise above it, and, when the water was low, form a small island.

Another circumstance drew attention to the Steinberg quite as much as the mass of rolled stones, and this was the appearance of a series of piles, which originally seem to have occupied the whole of the summit, but now are only partially visible. When passing over the place in a boat, piles may still be seen standing, sometimes single, sometimes in straight or curved lines, and sometimes in groups, projecting two or three feet from the bottom on the highest part of the Steinberg and three or four feet at the sides where the water is deeper. As a great proportion of these piles have rotted away, or may be covered with mud, and a number of them have been pulled up by the boatmen, their original arrangement cannot now be ascertained, and their appearance to the eye is at the present moment that of a confused mass of dark points or dots. Where they are found together in the greatest numbers they stand from 1 foot to 3 feet apart. Most of them are whole trunks, only a few were made out of split stems; they are from 3 to 10 inches in diameter: they have been driven 2 or 3 feet deep into the bottom, and the lower ends were sharpened by fire. Most of the piles which have been drawn up consist of oak, beech, and fir. It is worthy of note that there are a considerable number of trunks found here lying horizontally, which evidently have not fallen down in this position by chance, but have been intentionally sunk to the bottom: some of them are squeezed in between the upright piles, and join each other at right angles, but the majority lie confusedly in all directions, and show very much less of an intentional arrangement than the upright ones.

It is singular that the actual importance of the Nidau-Steinberg was never known till after the discovery of the lake dwellings of Meilen. It is true that at different times a number of Roman tiles had been found some hundred paces from the Steinberg where the cut or canal from the Scheuss falls into the lake, and some fragments of the same kind had also been observed on the hillock of the Steinberg itself; and the neighbouring inhabitants consequently ascribed these piles to the Romans, and imagined that they formed the wooden foundation of a lighthouse or some fortified place; but they found it difficult to account for the total absence of mortar and hewn stone, and also for the length and slenderness of the piles.

The place, however, was examined by Mr. Müller of Nidau and Colonel Schwab of Bienne, who spared neither time nor trouble, and from their zealous and careful investigations we are now able to say with certainty that a settlement existed in this place, bearing the greatest similarity to that of Meilen and numerous other lake dwellings since explored. It is really almost incomprehensible that the Steinberg, the place of all others in the lake of Bienne most frequented by fishermen, and where day by day a number of small barks are stationed, should now for the first time appear as one of the richest localities for prehistoric antiquities, and afford such a number of beautiful and remarkable bronze remains as are to be seen in the antiquarian collections of Mr. Müller and Colonel Schwab.[1] Hidden by a coating of calcareous matter, they have for centuries escaped the notice of the fishermen who carried on their daily occupations above them, and till a short time ago they remained entirely unnoticed. But now, to the initiated eye, the piles appear as the substructure of the lake dwelling; the wood which, either burnt or half-burnt, lies about in great abundance on the bottom is recognised as the remains of former huts; the large number of fragments of pottery found in the mud as broken ancient vessels; and what appeared to be stones of a strange form turn out to be bronze hatchets and lance-points; nay, even many of the roundish rubble-stones most extraordinarily are found to have been used as implements in the most remote ages.

The drawings and descriptions of the objects found in Nidau will show that it was a flourishing station throughout all periods, from the stone age downwards. Many objects of stone, bone, and pottery which have been obtained there, and which mark the commencement of the civilisation of man in our districts, show that it was a settlement in the earliest period; but its existence was prolonged up to the time when bronze was commonly employed for implements; nay, it even outlasted this period, and reached that when iron came into use. Here and there on the same lake-bottom works of art are found lying close together, betokening very different grades of civilisation, and telling us of centuries lying far apart. The Nidau lake dwelling therefore coincides, on the one hand, with

[1] These two collections were afterwards united in the Museum of the late Colonel Schwab, and they are now in the public Museum of Bienne.

the settlements of East Switzerland which ceased to exist before the bronze age or at the very beginning of it, and, on the other hand, its existence runs parallel with those of West Switzerland which were first founded or came to their full development in the course of this period, and from which have been obtained such a great number and variety of bronze implements used for war, for household purposes, or for ornament.

We will now describe some of the most interesting antiquities found in this settlement.

I. OBJECTS OF STONE.

Many stones of different sizes and of various descriptions were found here which had been perforated and used for sinking nets. Some of the largest weighed five or six pounds, and were made out of roundish rolled stones surrounded by an iron hoop; and in order to keep this firm, a kind of hollow or furrow had been made all round the middle of the stone (Plate XXXVIII. fig. 15). There may be a doubt as to these iron-hooped stones being of the same date as the other remains found in this settlement.

Several of the objects commonly called slingstones have been found here. These singular disk-shaped stones (drawn in section, Plate XXXVII. figs. 1, 2, and 3, and also Plate XXXVIII. figs. 1, 2, 3, 4, and 7[1]) nearly all consist of yellowish or reddish quartz rock; they are circular, and have both sides flattened in general with a central depression: there is a groove round the edge, and they are ground or polished all over. They are from 4 to 5 inches in diameter and more than two inches thick. The central hollow varies in width from 1 inch 2 lines to 1 inch 8 lines, and is from 2 to 3 lines deep, and appears like a flat cup, the section forming the segment of a circle, as seen in the Figures 2, 3, 4, and 7, Plate XXXVIII. One of them, made of oolitic stone, is remarkable for its peculiar shape and excellent workmanship. These things, so similar to pulleys in form, evidently have had a great deal of labour bestowed upon them and deserve the especial attention of antiquaries. Their true use, according to our opinion, has not yet been ascertained, and we call them 'slingstones' simply because this name has been given to them in works on archæology. It is not to be supposed that stones which required all the art of the workman to bring them into proper shape should have been slung away in battle like any common stone picked up on the surface of the ground. As the sling is always broader in the middle, in order to keep the projectile as in a hood or cap, the form of these stones appears to make them totally unfit for the purpose assigned to them, besides which the grooves round the edge and the central depressions on the sides would be quite useless additions. Similar stone objects were found in the Celtic settlement of Ebersberg on the mainland. One of them is drawn Plate CXLIII. fig. 1. It is remarkable that slingstones of the regular form have not yet been discovered in the older lake dwellings, but on the contrary, a large number have been met with in the later settlements. Schoolcraft, in his 'History and Condition of the Indian Tribes of the United States' (Smithson. Instit. pt. i. p. 82), says that the game of stone-hurling is one of the most favourite of all amongst the wild tribes of North America. 'It is incredible with what accuracy the natives throw these stones to a given point. The number of disk-shaped stones which have been found in the tumuli and the ancient settlements show that this amusement was very common amongst the ancient races.[1] These old hurling-stones were made with great labour and skill out of very tough stone (porphyry). In the third part of this work, plate lix. fig. 1 is the representation of a roundish stone with a furrow, which was in the museum at Albany, and was considered as "a war-club."' Sir W. R. Wilde, in his 'Catalogue of the Museum of the Royal Irish Academy,' p. 95, figures a somewhat similar stone (fig. 77), and mentions the conjecture that it was 'one of what are called "flailstones," used in early Irish warfare, attached by a thong to a stick, and to which allusion is made in the account of the feats of the Ulster champion Cucullin.' At all events, the name of 'hurling-stone' or 'club-stone' is quite as suitable as the one hitherto used of slingstone.

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[1] Soon after the publication of the first edition, I received in 1867 a kind letter from P. L. Hussey, Esq., of Brighton, suggesting that these slingstones may have been drill wheels used in the process of boring the celts. It seems to me that this idea is extremely probable.—[TR.]

The stones called corn-crushers were also made of hard stone—granite or quartz-rock—and only differ from what are called slingstones by being more spherical in form, and by having no groove at the side or edge; they are generally 3½ inches in diameter and 2½ inches thick. The depressions are wider than in the slingstone, and are made with less care; those found here are in general very similar to the two from Meilen, drawn Plate II. figs. 7 and 8, but some consist merely of cylindrical stones, and are only to be recognised as grinding or crushing implements by being truncated above and below, and by the surface being rough; some specimens also have hollows or slight depressions on the two opposite sides, to allow of their being held more firmly.

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[1] A similar game appears to have been common amongst the ancient inhabitants of Cornwall. In the parish of St. Clere are three of the so-called Druidical circles, and the tradition is that the stones which form them were once men who were changed into stones as a punishment for 'hurling' on Sunday: they still go by the name of Hurlers ('Borlase,' p. 188).—[Tr.]

The 'mealing-stones' consist also of large unworked slabs of a hard kind of stone, but more tabular in form. On one of the two sides, and sometimes on both, roundish hollows have been made in the shape of the segment of a sphere, the diameter of which is some inches, and the depth varies from half an inch to an inch and a quarter. The surface of this cup is left rough; it was destined to receive the corn to be ground or crushed. The mealing-stone drawn Plate XXXVIII. fig. 5 (which was from Meilen) is precisely similiar to those found at Nidau.

The sharpening-stones or whetstones found here are exactly like those found at Meilen, drawn Plate III. fig. 5, and, like them, they consist of fine-grained sandstone.

What may be called grinding or polishing-stones (Reibsteine) are of granite, and are perfectly smooth and well polished. They have just the appearance of the stones on which the painters of the present day grind their colours.

Plate XXXVII. fig. 25 is a small perforated stone. Fig. 29 is also a small stone perforated on the three sides to allow a cord to go through. Fig. 10 is a bowl turned out of potstone. This material was employed in our districts in very early times for several purposes, and especially for pots or vessels; it was especially in use on the south side of the Alps in Maggiathal, in the district of Lavizzara in the canton of Tessin (hence the name of Lavez-stone).[1] A small vessel with an iron rim and a handle, exactly like those now made, was found in a tumulus near Pfäffikon, in the canton of Zürich, opened in the year 1854, and together with it there were iron weapons and bronze ornaments. Many vessels of this kind of stone, beautifully worked, are in the collection of Colonel Schwab. Fig. 26 is a large bead made of serpentine. Fossils were also used as ornaments, such as *Terebratulæ*, small *Ammonites*, and plates or joints of encrinites; crystals and variegated pebbles are also found which had served the same purpose.

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[1] Lapis ollaris, lapis Comensis. (Pliny xxxvi. 22. edit. Dalecampii.) Vessels of this kind of stone are, however, not older than the early iron age.

II. OBJECTS OF BRONZE.

The lake dwelling of Nidau is particularly rich in bronze remains. A large number of sickles have been found both at Nidau and Lattringen, very similar to each other both in form and size. They are like a half-moon, but with this difference, one half is less curved and is rounded at the point, while the opposite end is somewhat wider. On an average, the length from one point to the other is 5½ inches; the breadth of perfect specimens in the middle is from 1½ to 1¾ inch. On one side they are quite flat, and on the other they have either one, two, or three ribs running parallel with the outer edge, partly for the sake of strength and partly for ornament. They were all cast, as may be clearly seen by a projection in the middle of the border; sometimes even a portion of the metal was left standing, indicating the channel for pouring in the liquid bronze. The mode in which they were hafted is exactly the same as that in the bronze celts: they were fastened into a piece of split wood by means of cord or a nail. A very large number of implements of this kind are in the most instructive cabinet of Colonel Schwab, and in other Swiss collections, and I can give my assurance that of all I have seen no two specimens have been cast from the same mould. Many of the sickles found at Nidau-Steinberg appear to have been exposed to a violent heat. Two of them are drawn Plate XXXIII. figs. 1 and 2.

The specimens of bronze celts found here are with a single exception of the same shape and nearly of the same size, from 5½ to 6½ inches long (Plate XXXV. fig. 5). Towards the lower part they all have a projecting ear or ring, and they have flanges at the sides which bend round in a half-circle and nearly touch each other. In many celts, especially the flatter kind, may be noticed an incision or notch at the lower part (see the Transactions of the Zürich Archæological Society, vol. ii. part 7), into which a nail fitted, which prevented the celt from going back when a heavy blow was struck. This notch is not seen in the eared celts, and they have at this place a degree of unevenness which arises from the breaking off of the 'run' of metal, or what is called by workmen the 'gate.' There can be no doubt that a ring was attached to the ear, by means of which the celt was fastened to the handle.[1] ('Archæologia,' vol. xvi. plate 54.) In a few specimens some slight degree of ornamentation is attempted, by having the sutures or places where the mould joins together on the sides raised so as to become ribs. In one single small specimen the cutting edge stands at right angles to the body and the ear of the tool, thus giving it the form of the cross axe, such as is used by boat-builders.

Many of the celts found here appear from several indications never to have been hafted, and consequently never to have been brought into use. It is also worthy of remark that two of them cannot be found which were made in the same mould—a fact which indicates a very large number of moulds, and also the wide-spread use of these implements.

The admirable collection of the late Colonel Schwab is extremely rich in bronze knives, most of which were found at the Nidau-Steinberg. The shape of these knives is on the whole exactly like that of the bronze knives found in other European countries: the blades are from 3½ to 7½ inches long, and from about ½ inch to 1 inch broad; like the sickles, they are flat on one side, while on the other they are sloped like a razor, and are generally ornamented on this side with ribs which run parallel with the back. There are different kinds of handles; either the blade and handle were both cast in one piece (for all the knives were cast), or the knife was fixed, as is now the custom, with a spike (or what workmen call a 'sturt') into the handle, Plate XXXIII. fig. 4, or instead of the spike it had a socket, into which the handle was fastened. Plate XXXIII. fig. 5 is an example of the latter kind, and it is further remarkable for uniting in itself the ornaments usually found on several other implements, and which belong to the most superior products of Celtic art. Thus, the lower part of the handle is bifurcated like the hilts of many bronze swords; the upper part of the handle is ornamented like the sockets or barrels of the lance-heads, and the blade has ridges running along it like the ornaments on one side of the sickles. Figs. 3, 4, and 6 are specimens of the other descriptions of knives.

Fig. 10 seems to have been at the same time both an awl and a knife.

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[1] A celt obtained by M. Müller is especially worthy of attention, as it shows the mode of hafting, and actually contains the remains of its wooden handle. It was found in a tumulus on the mainland.

All the specimens of spear and javelin heads found at Nidau are of excellent workmanship and form; they probably indicate more than any other of the bronze implements the proficiency made by the colonists in casting. The length of these points or heads varies from 3½ to 13 inches, so that the smaller ones probably belonged to arrows or javelins, and the larger ones to spears or lances. Even if we imagine that the same implements were used both for war and the chase, yet in all probability those which had a long socket richly ornamented were chiefly used for warlike purposes. The weapon drawn Plate XXXV. fig. 3, is remarkable not only for the rings, both plain and indented, which run round the socket, but also for the serpentine ornamentation with which it is covered.

Plate XXXV. fig. 4 and Plate XXXIII. figs. 12 and 13 are other specimens of these spear and arrow heads.

Some smaller barbed arrow-heads are represented Plate XXXV. figs. 10, 11, 12.

Several sizes of bronze chisels have been found here. A broad chisel is drawn Plate XXXV. fig. 6. It is four inches long, is made with a socket, and the cutting edge has a sweep like that of a celt. The narrow chisels or spike-heads found at the Steinberg are, as far as I know, the only tools of this kind found in Switzerland. Drawings of two varieties are given, Plate XXXIII. figs. 7 and 8. Even these narrow chisels have sockets.[1]

Fig. 9 was at first considered as a kind of hammer, but it is now thought probable that it may be one of the anvils on which the swords, sickles, and knives were sharpened by beating. It has six sides and has a cavity in the centre. Fig. 9 *a* shows the upper view.

A very large number of pins, either for the hair or for fastening the clothes, were found at Nidau. A selection from them will be found Plate XXXIII. fig. 11, and Plate XXXIV. figs. 1 to 34. Some of the heads of these pins were hollow, and, as is mentioned elsewhere, little balls of lead or stones of a reddish colour were set in them. Similar pins are found in the Swiss tumuli.

Several needles, or at least similar implements, fitted for sewing, knitting, or what is now called crochet-work, are drawn Plate XXXVI. figs. 6 to 18.

Figs. 1 and 2 have a little chisel at one end, and a piercer at the other.

Fig. 3 appears to be a drill, which was fixed into the turning machine by its upper or broader end.

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[1] See Arch. Journal, 1852, p. 303.

Fig. 4. Surgical (?) instrument, curved and flat at the top (see the upper figure), bent round at the bottom, with a cutting edge directed outwards.

Fig. 5. A small shovel-shaped instrument or lingula; the figure to the left at the top shows the section.

The armlets drawn Plate XXXV. figs. 1 and 2, resemble hollow rings of which a portion has been removed: they are amongst the most singlar of the Celtic articles of the toilet. They are smooth inside, but on the outside they are richly adorned with impressed and engraved ornaments. They sensibly diminish in size towards the two ends, which are bent round into semicircular appendages. Their internal diameter is from 3 to 4 inches, their breadth from 7 lines to 1½ inch; the thickness of the metal plate is hardly a line. Two other armlets are drawn on a smaller scale (Plate XXXVII. figs. 34 and 35). The first of these is so thick that it would have been very inconvenient for the purpose usually assigned to them, and the same remark will apply to the armlet of which a portion is drawn Plate XXXIV. fig. 36; it is made of solid cast bronze, and is flat on the inside.[1] Fig. 35 is a smaller armlet, made of twisted bronze wire.

Rings made out of thin bronze wire, and from 2½ to 3½ inches in diameter, with hooks fixed to them, are considered as earrings.

A great variety of solid rings were met with; some of them made out of thick wire, such as those drawn Plate XXXIII. figs. 15 and 16, both of which have appendages, one a smaller ring, and the other a short rod; others were cast, such as those drawn Plate XXXVI. figs. 33 to 41. The very curious set of rings (Fig. 36) was not made by the smaller rings being bent round the larger one, but the whole was made by casting in a mould.

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[1] Some of the armlets, or 'manillas' as they are called, manufactured at Birmingham of solid brass, and sent out as an article of trade, almost by tons, to the wild tribes on the coast of Africa, are in fact heavier than most of the armlets from the lake dwellings. They are used by being clasped round a black lady's wrist, then hammered till the ends meet, and thus remain to her dying day. It may be interesting, as an additional fact, showing the use to which these modern armlets are put, to mention a story which came to my ears since the publication of the first edition. The master of a vessel trading to Africa wished to get a larger profit on these 'manillas' than before, and ordered a quantity to be made of cast iron bronzed over, which of course cost much less than those of solid brass or bronze. On his arrival at the coast he rapidly sold them, but when the natives found that the armlets would not bend, and that they had been deceived, they surrounded his vessel in such a hostile manner, that he was obliged to slip his cable and run to sea for his life.—[Tr.]

Plate XXXVI. figs. 19 to 32, represent a series of fish-hooks of various forms and sizes, some with and some without barbs, and with the shanks either bent round or notched. The section of the wire is in most cases quadrangular; in not a single case is it perfectly round and uniform. These hooks are exactly like those found in the Celtic settlement of Hallstadt in Upper Austria.

Plate XXXIV. fig. 37 is a hook, the use of which is unknown.

The knob drawn Plate XXXIII. fig. 14, is provided with a socket; it may possibly have formed the end of a knife-handle, or the bottom of the shaft of a lance, but from late discoveries at Möringen it is far more probable that it was the terminal knob of a scabbard or sheath of a sword.

Plate XXXV. figs. 13 to 24 are cutting implements of various kinds made of cast bronze. In Figs. 13 to 20 the back is nearly ¾ of a line thick. Some of them are perforated or have rings, and seem as if intended to be worn (Figs. 15, 17, 18); others have ridges on one side like the sickles (Fig. 24), and again others are ornamented with engraved lines like Fig. 23. The Figs. 16, 20, 21, and 22 nearly have the form of knives.

Figs. 8, 25, 26, and 27 are knobs or studs of various kinds. Figs. 7 and 9 appear to be ornaments.

Fig. 30 is a specimen, the use of which is unknown; it has two truncated horns, and may possibly be allied to the moon-images.

Fig. 29 is a spiral made of bronze wire; the section of the wire is like that of an early crescent moon.

Plate XXXVII. fig. 32 is a piece of bronze wire, wound round into a kind of spiral form at each end.

Fig. 33. Bronze implement of the size and shape of a snaffle-bit, and which probably was used as such (figured ⅙th natural size).

Fig. 5 is a bronze hammer with an ear.

Plate XLVII. fig. 3 is a bronze sword.

Plate LVIII. fig. 3 is a bronze clasp.

Plate LXI. fig. 2 is a bronze pin with a hollow head.

III. OBJECTS OF GOLD.

Plate XXXV. fig. 28 is a spiral of gold wire, square in the section, first twisted round on itself and afterwards coiled into a spiral form.

Plate XXXVI. fig. 42 is a gold plate, ribbed, or, in modern language, corrugated.

IV. OBJECTS OF IRON.

Iron spear or javelin heads, more than 6 inches long, have been found here similar to those drawn Plate XC. fig. 2, from Sutz; they are made out of iron plate bent round so as to allow of their being fastened to shafts. The iron hoop on the large net-weight, drawn Plate XXXVIII. fig. 15, has already been mentioned. It is certain that these objects do not date from the same period as the bronze implements.

V. OBJECTS OF CLAY.

The remarks which were made respecting the pottery at Meilen for the most part equally apply, both as to form and material, to that found at Nidau-Steinberg, the settlements near Lattringen, Möringen, &c. At Nidau and Lattringen the works of the potter are found in great abundance and variety of form, and many of them have been so well preserved that without much trouble they can be arranged in regular classes, and we are able to get a pretty clear idea of the uses to which they were applied and also of the degree of artistic skill attained by the workman.

From the specimens which have been found here, we may also be very certain that the whole of them were made by the hand alone, and that the potter's wheel was unknown. They have also been made of similar material to that of the pottery from other stations, but with this difference: the clay, which was used unwashed, has been mixed up, not with gravel or granite-grains, but with charcoal-dust or pieces, some of them of the size of millet-seed, and in such quantities as to give a dark-grey colour to the mass. Lastly, they were burnt, ornamented, and painted in the same manner. Some vessels were found here of extraordinary size, the mouth being three feet across, which may have been used for storing up corn and other things. The smaller vessels appear to have been intended for the reception of fluids, and also for cooking. Then we have dishes, basins, bowls, and drinking-cups of very different forms and sizes. As these vessels agree in every respect with those found in the tumuli (described in vol. iii. of the Transactions of the Antiquarian Association of Zürich), we must refer to what was then said as to the different sorts and the uses to which they were applied; but we will select from the row of vessels now standing before us certain specimens for closer examination.

With respect to the largest, of which, unfortunately, only a fragment has been preserved, the question arises in the mind of everyone who sees it what possible means there could have been for making a vessel of such size, so regularly formed and with such thin sides or walls, and how it could have been burnt without the use of a close fire. According to my notion, the correct answer to this question is given in the accounts of the earlier travellers, who describe the mode in which earthenware vessels, just as large as this one, are made by people in a similar state of civilisation to that of the inhabitants of our lake dwellings. The Arrowaks, the ancient inhabitants of Jugana, according to the account given by Davies (p. 263), make their earthenware vessels in the following manner: 'When they commence a vessel, after having mixed the clay with powdered charcoal, they make first a round disk or slab, which always is very small even for large vessels; they then make of the same kind of clay small sausage-shaped strips about as thick as the finger, which are made to adhere to the under disk and pressed flat with the fingers. Thus they go on, till the vessel has become of the requisite size and shape. They make dishes in the same way, which are often so thin that it is marvellous how with the hand alone they are able to bring them to perfection and to give them such a regular form. In the course of the work, when the clay has become partially dry they polish it with a smooth stone. Most of these vessels are round at the bottom, so that they would not stand well on level ground, but would have to be placed on a foundation of sand. They often make water-vessels so large that a European potter could hardly manufacture them on the wheel; they also make excellent pipkins. When the vessel is sufficiently dry, and more especially if it is of large size, a hole is made in the sand, and brushwood or any kind of wood that burns easily is laid under and around it, and also some little inside if the sides are thick, and thus it becomes well burnt.' ('Neuwied,' ii. 127.) 'The North Americans also manufacture vessels of burnt clay like those found in abundance in their ancient burial-grounds; they are made of grey clay, and the surface is very much marked with rings.[1] Broken shells are found plentifully in the dark-grey material of these vessels.' ('Neuwied,' ii. 127.) 'The Mandans and other races manufacture earthen vessels of dark slate-coloured clay mixed with gravel and granite.' (Klemm's 'Cultur Geschichte,' Bd. iv.)

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[1] Some fragments of pottery which had this peculiar style of ring ornamentation were exhibited at the meeting of the British Association at Birmingham, by Principal Dawson. They were from Hochelaga, the ancient Indian settlement on the site of which Montreal now stands, which can be historically proved to have been abandoned by the native tribes 200 years ago.—[Tr.]

It is remarkable that in the vessels found in the lake of Bienne the base is of very small diameter; sometimes, in fact, there is none at all. The drinking vessels are almost always round, or made so that they will not stand on a level surface (Plate XXXVIII. figs. 6, 8, 9, 10, 11, 12, and 13). Some of the urn-shaped vessels are covered with a bright and beautiful black coating made by graphite, and yet they have the peculiarity of not soiling the hands when touched.

Plate XXXVII. figs. 27, 27′, and 28 are earthenware vessels like plates, coloured red and black; they are exactly similar to those found in the tumuli at Dörflingen and Trüllikon, both in material and also as to shape and ornamentation. (See the account of the Helvetian 'Heidengräber,' vol. iii. Plate V. fig. 5, and the general remarks upon them, page 77.) Fig. 30 is a double earthenware cup.

One vessel was found on the Steinberg perforated at the sides like some found at Ebersberg on the mainland and also in several lake dwellings. It is that drawn Plate XXXVIII. fig. 6; it has several ornamental parallel lines encircling it like hoops, and the perforations above referred to have been made in these lines, and run in an oblique direction, as mentioned elsewhere; the use of these vessels is rather problematical, but they are commonly thought to have been intended for preparing cheese.[1]

Many of the earthenware vessels found at the Steinberg were filled with charcoal; others had been damaged by the fire when the settlement was burnt; some few pieces of pottery had been almost melted by the violent heat, and had doubled up or run together.

It is singular that the clay rings which are so very plentiful in the lakes of Bienne, Neuchâtel, and Geneva, were not found at Meilen. One of them from Nidau is drawn Plate XXXVIII. fig. 14. These rings are made of clay mixed with little stones and pieces of charcoal, but they are imperfectly burnt, and very little care has been bestowed upon them; they vary in external diameter from 3½ to 9½ inches; the hole in the middle is from

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[1] Mr. Müller informed me that at the present time similar vessels, though perhaps of larger size, are manufactured by the potters in the valleys of the Jura. They are used for separating the curdled part of the milk—the substance of the cheese—from the liquid part which runs off through the holes.

7 lines to 2¼ inches wide, and the thickness of the ring itself varies from 1 inch to upwards of 2 inches. Various opinions have been expressed as to the use of these rings. The idea that they were net weights is now abandoned. It seems now ascertained that they were used as supports for the vessels which either had no base at all or one so small that they would not stand. There can be no doubt also that they were used in a similar way as supports for pipkins with a conical base when placed on the hearth.[1] Many of these rings appear to have become friable from the action of violent heat, but it is not always certain whether this happened on the hearth, or when the settlement was burnt down.

A considerable number of spindle-whorls are to be seen in the collections from this locality. The specimens drawn (Plate XXXVII. figs. 17 to 24, and Plate XXXVIII. fig. 17) will give some idea of the variety in form and ornamentation. Most of them are made of purified clay blackened with graphite and rubbed smooth. The fact of one side being always flat and without ornament prevents our considering these things as beads. English antiquaries consider the little disks of earthenware slightly raised, which are so commonly met with, to be the pieces or counters of a game still in use amongst seafaring people. The hole allowed the counters to be placed on the wooden pegs fixed on the playing-board.

'Sink-stones' or Weights.—The things which commonly go by this name are about 4½ inches high, of a conical form, and are about 4 or 4½ in diameter at the base; they were made

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[1] In 1868, in the Royal Museum at Naples, I noticed amongst the specimens from Pompeii some small earthenware vessels about 5½ or 6 inches high with conical bases, and also the terra cotta rings which supported them, and which were from 2¼ to 3 inches in diameter. It almost seems as if the inhabitants of Pompeii had continued at least one of the customs of the prehistoric inhabitants. The annexed woodcuts are from sketches taken on the spot.—[Tr.]

Fig. 19.

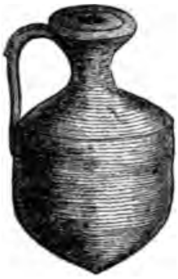
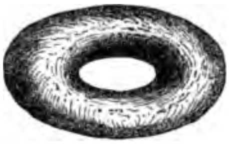


Fig. 20.



without any care and of common clay. The fact that they are perforated towards the point of the cone, and that they were found at a fishing-station, seems to argue for the correctness of the common designation, but subsequent investigations have proved that many at least of these clay cones were simply weights used in weaving, and the reader is referred to the chapter on flax and its manufacture for further particulars. Plate XXXVIII. figs. 16, 18, 19, and 20, may come under the class of weights. The object drawn in two views, Figs. 18 and 19, and possibly also Fig. 20, seems to be of Roman origin.

Plate XXXVII. figs. 9, 15, and 16 are perfect and imperfect specimens of the well-known and problematical crescents, made of clay mixed with quartz-grains. About two dozen of them are in the collection of Colonel Schwab. The reader is referred for more particulars to the special chapter on these curious objects. Fig. 4 is an ornament (?) of earthenware.

Figs. 6 and 7 are cylinders of earthenware; the middle part is rather smaller than the two ends. The use of them is not known with certainty, but they may have served as supports for the pipkins in the hearth-fires, and have had the same use as the clay rings above referred to.

Plate XXI. fig. 15 is a drawing of what is probably one of the most curious objects found in this settlement: it is a rude figure of a lizard (?) in earthenware, and is remarkable as being, when it was found, the only attempt known to represent animal life: since then several other figures of animals have been discovered, both in Switzerland and elsewhere. See Plates LXXVIII. and CLXXXVII.

Several lumps of clay were found here from 1 to 3 inches thick, smooth on one side, and on the other having the impression of wattlework; they are pieces of what once formed the covering of the hut walls, burnt hard when the settlement was destroyed by fire.

OBJECTS OF BONE, HORN, WOOD, ETC.

Fig. 8, Plate XXXVII. Three arrow-heads of bone. Fig. 11 is a specimen made out of stag's horn, perforated with square and round holes; the use of it is unknown. Fig. 12 is made out of a bear's tooth, and the use of it also is not known. Fig. 13 is a whistle made out of one of the small branches of a stag's horn. Fig. 14 is a string of beads of glass and jet. The glass beads are exactly like those found in such extraordinary numbers in the tumuli of later date and in Roman stations; they consist of the same sort of material as was employed for the better sort of tesseræ or mosaic cubes and for the counters used in games. Respecting the use of jet as an ornament, see the 'Rheinländische Jahrbücher,' Heft xiv. Fig. 31 is a yoke of yew-wood, used by the earliest population of the country for carrying all sorts of burdens. Two clubs of oak-wood were found here, one 20 inches long and the other 3 feet: they are like that from Meilen drawn Plate III. fig. 14. A boat lies embedded in the mud on the Steinberg, made of one long thick trunk of an oak, merely hollowed out either by fire or by hatchets the whole length of the bole. Boats of this description are still to be seen on the lakes of eastern Switzerland, as, for instance, those of Lucerne and Sempach. They go by the name of 'Einbäume.'

MÖRINGEN.

As this is one of the most important bronze age stations in Switzerland, it will be well in the first place to give the notices respecting it, which were printed in the first edition of this work, and which contained all that was known up to the time of its publication; then to give the account of it published by Dr. Von Gross in the seventh report of the Zürich Society's proceedings; and lastly to supplement these accounts by pretty full extracts from Mr. E. van Fellenberg's report on the settlement, which will show with what care the station has been investigated; concluding with a notice of the plants and seeds by Dr. J. Uhlmann, and a short list of the animals by Dr. Thes. Studer.

The village of Möringen is situated about a quarter of an hour's walk from Lattringen on a bay, the northern portion of which is called the Nook of Möringen. Its position will be seen on the map in Plate XL. In the middle of this bay there is an elevation of the bottom covered by about 6 feet or 6½ feet of water. Although this place is only higher than the space between it and the shore by about a foot, yet it has received the name of the 'Steinberg' chiefly from the number of stones which are scattered about upon it artificially. The 'Steinberg' of Möringen is about half an acre in extent, and is about 300 feet from the shore. Möringen was the first place which was known to M. Müller as a locality for antiquities, and which he first worked to advantage; and for three years he enriched his cabinet from this place with many interesting specimens. Amongst them was an iron sword in good preservation, Plate XL. figs. 2 and 5 (drawn one-fifth of its actual size), and a remarkable iron fork, 8½ inches long, provided with appendages at the sides, Fig. 3.

The late Col. Schwab also procured from this place many interesting antiquities. He found charred apples, rope made of bast, cords made of flax, grains of wheat, small beans, &c. From the numerous collection made by him we have selected the following objects to be drawn.

Plate XLI. figs. 1 and 2, bronze knives. Fig. 2 is hafted with stag's horn; Fig. 3, a bronze pin; Figs. 4 and 5, different views of a bronze celt of a form unusual in the lake dwellings; Fig. 7, a round bronze plate ornamented with knobs; Fig. 11 is a small bronze awl fixed in a wooden handle; Plate CXL. figs. 3, 4, and 5 are three round plates of bronze ornamented in different ways; Plate XLI. fig. 17, bronze implement for suspension; Plate XC. fig. 8, one of the well-known 'crescent knives' of bronze, this specimen is sharp at the outer edge (like a leather-cutter's knife); Fig. 9 is a bronze knife of very elegant form and beautiful ornamentation. The number and variety of bronze knives found in the lake dwellings are perfectly surprising, but this knife is probably the most beautiful of any yet found.[1]

Several rather peculiar specimens of earthenware have been found here. Plate XLI. fig. 10 is part of a vessel with a kind of spout; Figs. 12 and 14 are shaped like saucers; Figs. 15 and 16 are different views of a fragment of a vessel in which the handle is made inside; Fig. 18 is a drinking cup. Plate XC. fig. 16 (drawn also Plate LXXXI. fig. 3), is one of the regular crescents of earthenware, ornamented with vertical lines, arranged in irregular groups. Plate XXII. figs. 27 and 28, represent a cup with feet, an arrangement which is very rare in the lake dwellings. Plate XLI. fig. 6 is a bone arrow-head; Fig. 9 is a weaver's shuttle, also of bone; Fig. 13 is a string of beads made of glass and amber, and also three spirals of bronze.

Of Wood, Fig. 8 is the drawing of a large mallet, and Plate XC. fig. 6 is a cup with a handle cut out of yew wood, and not of maple wood as was at first imagined. Plate XL. fig. 4 is

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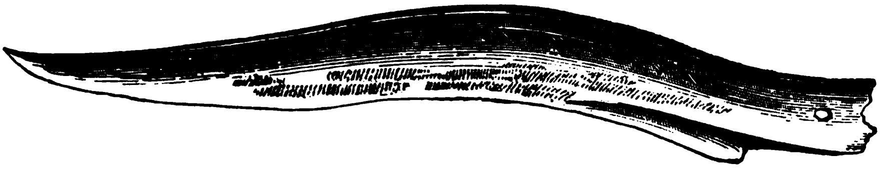
[1] The late Sir Gardner Wilkinson kindly pointed out to me the great similarity, if not identity, both in form and ornamentation, between this knife and one which he found at Thebes, of which the accompanying woodcut is a representation, taken from a sketch obligingly communicated by him.

Fig. 21.



Sir Gardner's opinion was that this knife is of a Gaulish type, and he accounts for its presence at Thebes by the fact well known in history that Ptolemy Philadelphus had in his service a troop of Gaulish soldiers, and that others of the same nation were employed by the celebrated Cleopatra. It is singular that an illustration of lake-dwelling antiquities should come from the far distant land of Egypt; but anyone who compares the two knives will be struck with the resemblance, and will be satisfied that the ornamentation in both cases springs from the same source.—[Tr.]

the drawing of what is called an 'Einbaum,' or canoe made out of a single stem; three of these may be seen in the vicinity of Möringen.[1] Two canoes of this description from Vingelz and one from Cuddefin are fully described in the present volume.

This was all that was known of this station when the first edition of this work was published. It will be seen from the accounts about to be given what large advances have been made in the knowledge of its antiquities; but before passing on to the account of Dr. Von Gross, it may be well to mention here three specimens which came from the Lake of Bienne, but the precise locality is not given, though it is probable that they came from Möringen. Plate XLIV. fig. 4 is a hook made of stag's horn; Fig. 21 is a bone pointer or awl; and Plate XLV. fig. 2 is part of an elk's horn, worked.

Notes on the Lake Dwelling of Möringen. By Dr. Von Gross.

Of all the bronze age stations hitherto explored in the Swiss lakes that of Möringen is justly considered one of the most important, both for its extent and on account of the number of remains of primitive industry found there.

The piles, which are chiefly of oak, and which project from the mud, in some cases 15 inches and in others 2 feet, extend over an area of nearly three acres (English). The settlement is in a sheltered position at the foot of the hill on which is situated the hamlet of Möringen. The bridge leading from the principal station[2] to the shore is 984 English feet long and about 13 feet wide. In some parts of the station, principally on the north side, the piles are covered with sand and mud, and it is only by testing the ground that one can be certain that the relic-bed is there. This bed, the composition of which is exactly the same as that of all the lake dwellings of the stone age, is on the average from 8 to 20 inches thick. In some places one may see between the piles large pieces of burnt wood resting on the sand, a quantity of pieces of pottery, and some trunks of trees, hollowed out, which had been used as canoes.

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[1] Similar boats are still in use in some parts of Switzerland, as, for instance, on the Lakes of Lucerne, Zug, and Aegeri (in the canton of Zug). On the banks of the latter lake they are still manufactured, and Dr. Keller informs me that in the spring of 1865 he saw a boat of this description in the harbour of the town of Zug.—[Tr.]

[2] Mr. E. de Fellenberg has proved the existence of a small stone age station situated between that of the bronze age and the shore.

At first one was satisfied with examining this station by means of the forceps, and fishing up the different specimens scattered over the surface between the piles. But by this mode of proceeding only those specimens were obtained which were already damaged, and all of them were covered with a coating of hardened mud. It was only of late years that the idea was adopted of searching the relic-bed by the hand drag, and thanks to this mode of working, the specimens found are so well preserved that they seem to have come but recently from the founder's workshop. In fact, some specimens, by the total absence of all patina and by their brilliant metallic lustre, have even raised doubts amongst the most competent experts as to their authenticity.

The excavations originally begun in 1852 by Messrs. Müller and the late Colonel Schwab, and of late years continued with more regularity, have brought to light so large a quantity of specimens, most of them in bronze (some few in iron), in stag's horn, in wood, and in stone, that it will be necessary to class them in different groups, as follows :—

I. ARMS.

a. Swords.
b. Daggers.
c. Lances.
d. Arrows.

II. IMPLEMENTS.

e. Celts.
f. Polishing stones, discoidal stones, anvils.
g. Spindle weights and weights for weaving.

III. OBJECTS OF DRESS.

a. Belts and belt buckles.
b. Pins and fibulæ.
c. Bracelets, rings, earrings, beads of amber, glass, &c.

IV. OBJECTS BELONGING TO HORSES' HARNESS.

a. Horses' bits in bronze, iron, and horn.
b. Phaleræ.

V. POTTERY, CRESCENTS.

VI. SUNDRY SPECIMENS.

I. ARMS.

a. Swords.—Plate XLVI. fig. 3,[1] a very beautiful bronze sword covered with deep blue patina and in perfect preservation; the hilt is in shape much more like those from the north of Europe than any others hitherto obtained from any lake dwellings.[2] The sword is 26 inches long, including the hilt, of which the part intended to be grasped by the hand is only 2¾ inches long.[3] The blade and the hilt, which were cast separately, have been fastened together by two rivets on the crosspiece. The blade is a little notched or cut away on each side, just below the hilt, it then becomes a trifle narrower for a third of its length, and then again wider till within 11 inches of the point, which is blunt. It was evidently a weapon more used for striking than stabbing. The blade is ornamented on both faces with three pairs of raised lines, running parallel to the cutting edge and uniting towards the point.

The hilt, cast in a single piece, is short and massive, and is furnished with a kind of crosspiece 2¾ inches wide over the whole. It does not terminate in volutes, as in the swords of Concise and Luissel, but by an enlargement forming an oval button, slightly concave at its terminal face and convex on the opposite side.

The body of the hilt is like a flattened cylinder, enlarged in the middle. The two extremities widen so as to form at one end the crosspiece and at the other the terminal button. It is ornamented with nine concentric cords a little raised, placed in rows of three together, between which on the median line are little rounded projections in imitation of rivets. The terminal stud or button is also ornamented on the convex face with three concentric cords or lines, and its terminal face has in the centre a rounded projection which might be mistaken for the end of the blade carried up and riveted here. With this sword was found in the relic-bed a specimen which evidently formed the extremity of the sheath or scabbard,[1] Plate XLVII. fig. 10. It is a terminal knob rounded with a socketed projection about 2 inches long. This socket is flattened and exactly fits the point of the sword just described. The scabbard itself was of wood, as may be seen from the carbonised remains which still cover the inside of the socket under consideration.

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[1] It may be well to mention that the plates illustrative of Dr. Von Gross' excellent paper are actual transfers from those in Dr. Keller's seventh report. Professor Desor has also published a number of drawings, full size and in colours, of many of the specimens from which these drawings were taken. His volume is entitled 'Le bel âge du bronze lacustre en Suisse,' and he evidently seems to consider that the bronze age was in its perfection at the moment when iron appeared. It seems to me that though the specimens from his drawings are most beautiful, yet he has not positively proved that they belong to the age when iron first appeared. It may be so; but if an Englishman may express an opinion on Swiss antiquities, I do not see any positive proof of this. May not some of the best specimens drawn in Mr. Desor's work have belonged to an earlier period?—[Tr.]

[2] A sword of the same type has been found in the Lake of Bourget; a second is in the museum at Carlsruhe; others have been found at Vaudrevanges, at Rozano, &c. See Gozzadini, De quelques mors de cheval italiques et de l'épée de Rozano en bronze. Bologna, 1875.

[3] The entire handle is about 3½ inches long. With respect to the size of the hilts of the weapons of different people, see the interesting notice of M. G. de Mortillet, Origine du bronze. Paris, E. Leroux, 1876.

Another sword of the same metal and type as the last; it is, however, smaller, and the blade has been cast at the same time as the hilt. The whole of the ornamentation on this specimen consists of three ribbons, slightly in relief, about one-fifth of an inch wide, which run round the middle and the two extremities of the body of the hilt.

A third sword, Plate XLIX. fig. 1, also of bronze, but of a different type from the preceding ones. Swords of this shape have not hitherto been known to occur in the lake dwellings. The hilt, which is rather large, is fixed to the blade with three rivets, one of which is in the middle and the two lateral ones are near the crosspieces.[2] These last are short, and are only 2⅙ inches long. The body of the hilt is of a cylindrical form, ornamented with a number of projecting rings. The upper part is not an oval stud or button, but a square bronze bar, rather more than 1½ inch long, terminated by a bronze plate of a circular form. This bar or rod was evidently intended to support a fillet of wood, horn, amber, or perhaps of ivory, like the swords found at Hallstatt. The hilt is ornamented with a series of circular furrows and with chevron patterns, inlaid with little bands of iron. The blade differs from the ordinary type, as the cutting edge is not undulated and is without the usual notches just below the hilt.

Plate XLIX. fig. 2 is the drawing of a sword which already marks the transition from bronze to iron; it has some resemblance to the beautiful Hallstatt swords. This sword has an iron blade fixed in a bronze hilt, and both in form and ornamentation is exactly like those just described, only it is larger in size. The blade, with an undulating cutting edge, is 26 inches long; it is notched or cut away at the sides just below the hilt, and is ornamented with striated projecting lines, following the direction of the cutting edge; its greatest breadth is about 1¾ inch. It has been very skilfully worked with the hammer, and it has undergone but very slightly the operation of tempering. In some places, especially where the blade appears to have been exposed to a sharp fire, a very distinct horizontal line of demarcation may be noticed, separating the blade into two parts. This fact led me to believe that it had not been forged from a single piece, but that it had been made by cleverly welding together two plates of iron.

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[1] A specimen somewhat similar to this was mentioned in Dr. Keller's first report, and drawn Plate V. fig. 18 (Plate XXXIII. fig. 14 of the English edition), but was by mistake described as the ferrule of a lance staff or the handle of a knife.

[2] A similar sword was found near Rud in Sweden, and is mentioned in the above-named work of Gozzadini.

The hilt, which unfortunately is imperfect, has been cast in bronze, and is provided with straight cross guards on which may be seen distinctly a zigzag ornament of a black colour, made of narrow bands of iron inlaid within the bronze. In order to effect this result the workmen would probably have to adapt these little bands of iron to the interior of the mould before casting the bronze. The whole sword has been exposed to a sharp fire, and this may explain to us the fact of numerous globules of bronze being seen on the surface of the hilt and even of the blade. These globules apparently have been derived from the fusion of some bronze object near to it, possibly of the scabbard belonging to the sword.

This iron sword, made on the same model as those of bronze, is interesting in more than one respect. On one hand it demonstrates to us that the spirit of imitation has been the same in all ages; for just as at the end of the stone age copper or bronze celts were made after the model of those of stone, so also towards the end of the bronze age, when the new metal iron became less rare, it took the place of bronze for making utensils and arms without any notable change in the manufacture. It shows us also that the appearance of iron in our districts did not take place suddenly, as if introduced by a conquering race, according to Troyon's ideas, but that it resulted from commercial relations which were gradually established amongst different peoples.

b. Daggers.—Daggers are much rarer than swords. I have only found one specimen with a triangular and very sharp blade; it is ornamented like the swords with longitudinal grooves, and at the base there are also four bronze rivets. It is 4½ inches long.

Another blade of thin bronze, Plate LVIII. fig. 10, has two cutting edges, and a strong tang or angle for insertion. It is more than 4¾ inches long, and is very similar to some of the weapons found at Peschiera (see Plate CXIX. figs. 16 and 17).

I have no hesitation in classing amongst the daggers a curious implement found by M. Desor, and which forms part of his rich collection, Plate LX. fig. 1. The blade of this implement, if I may use the expression, consists of a thick bronze rod 21 inches long, which at one end is tapered to a point, and at the other has been hammered into a quadrangular shape. The handle of this weapon, which is about 3½ inches long, and artistically worked, has a square socket, into which is fitted the quadrangular bar spoken of above. The handle has at the top a ring upon which there are three moveable rings of equal size, and at one side there is a kind of curved handle, below which is an appendage somewhat in the form of a swan.[1] The handle with all its accessories has been very skilfully made at one casting. The weight of the implements is about 8½ ounces English avoirdupois.

c. Lances.—About thirty specimens have been found, all of the ordinary type of our lake dwellings. One alone is remarkable for its size, being more than 10 inches long, and also for its original ornamentation. On the socket there is a series of concentric ribbons, made of pure copper and of ordinary bronze, which must have had a very good effect.

One weapon, which evidently has been used as a lance or javelin, is made out of the broken piece of a sword about 7 inches long. The end opposite to the point is cut away on each side, so as to form a kind of tang or stalk, which might more readily be inserted into a wooden staff or pole, Plate XLVII. fig. 4.

d. Arrow-heads.—These weapons are very rarely found at Möringen. Only five specimens have been obtained, one of flint and the rest of bronze. Amongst the latter, one, Plate XLVII. fig. 11, has a very neatly made socket; two others, Plate XLVII. fig. 9, have a tang and two lateral wings; the fourth, Plate XLVI. fig. 6, is made of a thin bronze plate cut in the shape of a lozenge.

Plate XLIII. fig. 9 is the point of a javelin made of stag's horn; it has a kind of socket.

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[1] Or more probably a snake (?)—[Tr.]

II. IMPLEMENTS.

a. Celts and Sickles.—About forty celts were found here, mostly of a uniform type. They vary in length from 4¾ to 7¾ inches. The end opposite to the cutting edge always has four wings curved back, and on the side there is a kind of ear apparently intended to fix the implement more strongly by straps or binding material of some other kind.

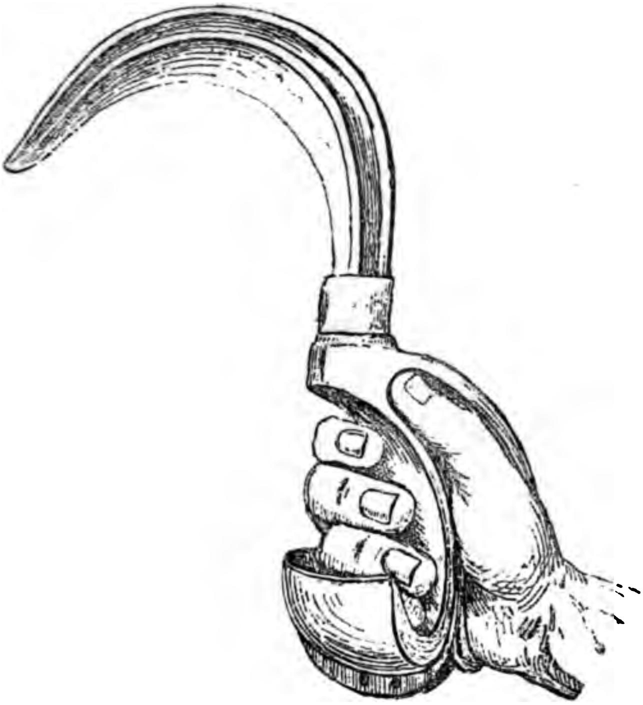
Some specimens, of small dimensions, differ from the ordinary type by the wings being placed on the same plane as the cutting edge, so that they must have been used for some especial purpose, like similar tools used at the present day by shipbuilders, Plate LIX. fig. 12. None of the Möringen celts have the primitive form of the spatula, like those found in the lake dwellings of the stone age. One single specimen has a rounded socket for the insertion of a handle.

While the dredging was in progress I several times obtained many fragments of the forked staffs to which the celts were fastened; but it was not until the level of the water had been lowered, so that the works could be executed as it were on terra firma, that a celt was found in the relic bed quite perfect with its handle. This handle, which is about 29 inches long and about 1¼ inch thick, is rounded and swells out at the end. Owing to this arrangement, the more the implement was used the more firmly was the celt fixed in the handle.

As agriculture was one of the principal occupations of our lake-dwellers, it need not surprise us to learn that sickles were found in abundance in the settlement under consideration. About thirty specimens were obtained. They are all rather small, of a semicircular form ; the whole of them were cast of a uniform type, but of various sizes. One side is flat, the other has projecting ribs under the form of parallel nervures, intended to ornament or to strengthen the blade, Plate LIX. fig. 10. One single small specimen has a stud or button for hafting at its base like most of the sickles from the lake of Bourget.

With respect to the manner of using this tool, it is probable that in general it was fixed like the celts at the end of a cloven stick. This, however, was not always the case, for I have lately had the good fortune to secure a handle intended for a sickle. It is made of hard wood, Plate LIV. fig. 1, and 1 *a*, 1 *b*, and 1 *c*; it is 7 inches long, made so that the right hand fits into the hollows completely and without any trouble. The two specimens which I have obtained are small, and appear more suited to the hand of a woman. The annexed woodcut shows the probable mode in which it was used.

FIG. 22.



Now that we are speaking of bronze sickles I ought to mention also the discovery of one made of iron with a straight blade lengthened and serrated exactly like those found in the station 'de la Tène,' see Plate CXXIII. fig. 7.

b. Knives.—Forty knives were found in the relic bed, but only a few are worthy of especial notice. Two specimens, one of which is nearly a foot long, have a bronze handle thus completing the implement; they are elegantly ornamented, and the end of the handle is perforated for suspension, Plates L. fig. 2 and L. fig. 5. Other specimens, Plates L. fig. 3 and LI. fig. 3, were found still hafted in their handles of stag's horn. The finest specimen, however, of this kind is one which has a conical handle artistically ornamented with circular lines incised in the horn. A kind of ornamentation entirely new may be seen on a very beautiful knife, now in the museum at Bern, Plate LI. fig. 4. At the beginning of the blade, or rather in the space between the blade and the spike or tang, there are several rings running round it of a bluish tint, these have been ascertained to be little bands of iron inlaid in the bronze.

One single knife had a socket in which the handle was fixed. To this class of objects belong those little implements with full and broad blades formed of a thin plate of bronze, with waved edges from 3 to 4 inches long by 1⅛ to 1½ inches wide, which some authors either rightly or wrongly have considered as razors (See Desor, 'Le bel âge du bronze,' p. 7). The side opposite to the cutting edge is strengthened by a thicker rib, and more often than not has a hollow or indentation fitted to receive the forefinger, Plate LII. fig. 6, and thus to facilitate the management of the implement. They have in general no appendage in the place of a handle, and were therefore grasped immediately by the hand. One single specimen (Plate LII. fig. 3) was found fastened by a rivet into a stag's horn handle 2¾ inches long, and perforated at the end for suspension. These implements are generally of cast bronze. That drawn Plate LIII. fig. 1 seems to have come direct from the mould, and was never sharpened. Others which have been worked by the hammer are more elegant, and are in general ornamented with patterns, Plate LII. figs. 1 and 4.

Two specimens are interesting, as they show to us the value placed by the lake-dwellers on the smallest portions of bronze; that drawn Plate LII. fig. 2 has been made by sharpening on one side the plate of a sword-belt[1] in which the casting had not succeeded, or which had been worn out by use. Another, Plate LII. fig. 5, which is ornamented with concentric circles, dotted or stippled, and with chevron patterns, has been made from the remains of a hammered bracelet similar to that drawn Plate LXIII. fig. 2. Plate LIII. fig. 5 has the handle part bent back.

Although the theory of razors may be very seductive, yet, in spite of the evidences adduced by the most competent archæologists,[2] I cannot bring myself to believe that these implements were really used to cut off the beard. I am rather disposed to regard them as having been made use of in religious ceremonies (their semilunar form might seem to indicate this), or, perhaps, which is more probable, they may have been used like our modern scissors to cut out cloth, leather, or some other soft material.

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[1] See Plate LVI. fig. 5, which is the drawing of the clasp or plate of a sword-belt very similar.

[2] See Ed. Flouest, Le tumulus du bois de Langres. Seamur en Auxois, 1872.

c. Hooks, Needles, Pointers.—All the hooks found at Möringen, about 200 in number, are of bronze, and exactly like our modern hooks. Double hooks are less common than single ones, and they are never armed with barbs. One specimen has a ring for suspension; another has been made out of a damaged pin. Fig. 4, Plate XLVI. represents what appears to be the end or point of a very large hook. About twenty needles with eyes were found; they are all of the same type, and vary in length from 2¾ to 3¼ inches. One specimen was of bone, and it was enclosed in a little hollow bronze cylinder which answered for a case. Several pointers or awls of small size were found: two of them were found hafted in a piece of wood more than 1½ inch long, Plate LVIII. fig. 12.

d. Chisels, Hammers, Saws.—A dozen specimens of chisels were obtained; some had a spike or tang, and were hafted in stag's horn. Others (Plate LV. fig. 3), which are of large size—up to 6½ inches long—have a socket; they are in general ornamented, and were used like carpenters' chisels. Some specimens have the cutting edge hollowed on one side, and have been used for cutting out grooves like our modern gouges.

Four hammers were found at Möringen, two of which had a square socket. They are about 1¾ inch long, and nearly an inch broad, and do not differ from those already described. One specimen has been made out of a damaged celt, Plate LVIII. fig. 16. Another, Plate LV. fig. 8, which is of a peculiar form, has probably been used to sharpen the finer tools by hammering. It is straight, rather long (2¾ inches), and about ½ inch wide, and has a squared socket, perforated at the sides for rivets to fasten the handle to the tool.

A long piece of cast bronze, flat, 1⅛ inch wide, covered on the broadest edge with transverse parallel serrations, has probably been used as a saw or a file, Plate LV. fig. 10.

e. Moulds.—For a long period it was generally considered that all the objects of bronze, whether found in the tumuli or in the Swiss lake-dwellings, were not of local origin, but had been imported from some foreign country which was imagined to be situated beyond the Alps. Of late years, however, it has been admitted that the most necessary tools, such as celts, knives, and sickles had been made in our country and those adjoining; for in Switzerland, France, and Western Germany discoveries have been gradually made of the very moulds in which a number of these implements had been cast, so that at the present day the question of their home manufacture is positively decided.

The station of Möringen, which is remarkable on so many other accounts, might be expected to yield its contingent of moulds, and to claim a position, not only as a typical settlement of the 'bel âge du bronze,' but still more so as an important centre of manufacture.

I had previously at different times obtained specimens, which led me to suppose the existence of a foundry here,[1] but it was only of late years that the moulds I am about to describe were discovered in the relic bed. They are all either of 'molasse' rock or of clay, not one was made of metal.

The molasse moulds seem to have been preferred for casting objects more or less flat, and those which have but few rough points, such as knives, sickles, pins, &c., while clay was employed for manufacturing embossed objects, and those which had hollows in them, such as bracelets, chisels, celts, &c.

The clay moulds are of two different types; they were either formed of a single piece, and could then only be used once, for they had to be broken after each operation in order to get out the object which was cast, or they were made in several pieces, which could be put together or separated at pleasure, and in this way they might be used several times.

The first of these types is represented by two specimens, one of which was employed to cast a socketed chisel, and the other a knife also socketed. The chisel mould, Plate LXXV. fig. 1, is somewhat cylindrical in form, but a little conical at one end; it is about 7¾ inches long and about 2 inches in diameter. The base of the cylinder is hollowed out like a funnel, at the bottom of which there are two rounded openings to receive the melted metal. The two perforations are separated by a narrow division, which is prolonged into the inside of the mould and forms a little cone. The 'cone' is about 3⅛ inches long. This of course when the casting was made would be hollow, and form the socket of the implement. The mould for a knife (Plate LXXIV. fig. 1) differs from the last chiefly in size, being 9½ inches long. And yet by making a longitudinal cut through the middle, I proved that it was formed of two distinct parts—first a median cylinder (the mould properly so called) made of a fine blackish clay which had been very well baked, and composed of two symmetrical halves fitted one upon the other; and secondly of another cylinder of clay of a greyish colour, coarse and less compact, which surrounds the first, and forms the external covering of the mould.

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[1] A large quantity of bronze waste from the crucible and of the 'gates' of the castings, of damaged tools and broken bracelets, collected together to be recast, also a little bar of tin and several rough implements, apparently just come out of the mould.

Amongst the clay moulds formed of several pieces I may mention a celt mould, Plate LXXV. fig. 6, unfortunately imperfect, and the mould of a socketed hammer in perfect preservation. This last, Plate LXXIV. fig. 4, is in shape somewhat cylindrical, about 3½ inches high and 2 inches in diameter, and is divided longitudinally into two halves exactly similar, which may be called valves, and which precisely fit each other. Between the two valves rather a thick 'core' is suspended, 2¾ inches long, which almost entirely fills up the interior cavity, and by means of which the socket is formed. This mould had been in actual use, for one of the hammers above described fits exactly into the cavity between the mould and the core.

The moulds made of the 'molasse' rock are more plentiful, but in general they are in a bad state of preservation. Some are broken to pieces, and others have the patterns upon them nearly effaced from having been so long in the water. The following are those which are tolerably perfect:—

1. A knife mould, Plate LXXIV. fig. 2, made of two slabs of molasse rock nearly 4 inches by 3. The two halves are symmetrical, and exactly correspond when placed one upon the other. The knife made in this mould would have a tang or spike, and would not be ornamented in any way. The mould where the point of the knife would be formed has the hollow part enlarged into a funnel to form the channel for pouring in the melted metal. The four 'marking holes,' intended for plugs of wood or bronze, so as to make the two sides fit each other, are very exact on both slabs, and the general plan of the mould appears to be still quite correct, notwithstanding the friability of the 'molasse' rock. This mould had been used for two purposes, for at the side of the knife-mould there is a furrow on both slabs corresponding with each other and evidently intended to cast a little rod of bronze, probably for a hairpin.

2. A sickle mould, Plate LXXV. fig. 5; quite perfect, made of a semicircular slab of 'molasse,' 5½ inches by 3½ inches, and

1½ inch thick. The hole for the melted metal is in the highest convex part of the sickle. On both sides of the mould there are two little channels to allow the bubbles of air to escape, which might damage the casting. Opposite to the hole for the melted metal there is also a similar hole for the escape of air. With the exception of these grooves the surface of the mould is smooth, and there are no 'marking holes.' These in fact would be superfluous, for, in order to cast a sickle, all that was necessary would be to fit on the mould a plate of 'molasse' with a perfectly level surface.

3. Several moulds for casting pins, Plate LXXIV. fig. 5, not very perfect; still it is easy to see the 'marking holes' and several longitudinal furrows in which the pins were cast.

4. Lastly, the mould for a lance-head, Plate LXXIV. fig. 3, quite perfect. The piece of molasse of which it is formed, and which is nearly 9 inches long, shows in intaglio the exact figure of a lance-head more than 7 inches long. The hole for the melted metal is placed at the end which corresponds to the socket. At some little distance below the wings there are two lateral furrows which communicate with the interior of the mould; these were intended to form the two lateral openings which are found in the sockets of lances.

It only remains for me to mention two specimens which formed part of the tools of the foundry workman, and which were discovered in the relic bed at the same time as the moulds just described. One is a fragment of a kind of retort of clay, Plate LXXIV. fig. 6, ornamented externally; the other is a vessel, Plate LXXV. fig. 3, which has been used as a crucible, and has the sides reddened by fire. It is more than 5 inches high, and about 4¾ inches at its broadest part. It differs from a specimen of ordinary earthenware by not being perfectly open at the top, the sides fold over so as almost to form a kind of covering or lid, and only a small rounded opening is left, through which the melted metal was poured. On the sides at some distance from the top there are two perforations for suspension.

f. Polishing Stones, Discoidal Stones, Anvils, Grinding Stones, &c.—Polishing stones of serpentine or molasse have been found in abundance; in general they consist of stones from 2 inches to 3½ inches long, which by use have become more or less triangular; they are marked with numerous striæ. Two specimens only were found in the shape of lengthened prisms, and which were perforated for suspension. There can be no doubt that they were used for grinding, polishing, or sharpening the knives, celts, sickles, and other similar implements of bronze. A dozen discoidal stones of granitic rock, reminding one of the pulleys of the present day, may possibly have been used for hurling in some game or other.[1]

Great stones of serpentine polished on one side and still of a bronzed metallic colour have probably been used as anvils. I may also mention some hammers of a cubical form, some pounding or grinding stones, some mealing stones, on which the corn was ground, and half-a-dozen stone celts like those from the neighbouring lake dwellings.

g. Weights for the Spindle and for the Weaver.—About 300 or 400 spindle-whorls of pottery have been found, but none of them are particularly remarkable, except that they are ornamented on one side. See Plate LXXXV., on which a variety of specimens from Möringen and Auvernier are drawn. Some of them had still fixed in them a little stem or rod of burnt wood, which takes away all doubt as to their use.

Several large pieces of clay of a square form are perforated for suspension, so as to be used as weavers' weights. Some are ornamented with patterns coarsely made with the finger in the shape of crosses or forming a series of parallel lines.

III. OBJECTS OF DRESS AND ORNAMENT.

a. Girdles and Girdle Buckles.—No metal girdles have been found at Möringen; still I have obtained one specimen of bronze, hammered and ornamented with 'repoussé' patterns, which may possibly be the fragment of a girdle like those found at Hallstatt. Little bronze plates[2] of an oblong form, with hooks on one side, have apparently been fixed to leathern girdles.

I have found two specimens of girdle buckles, Plate LVI. fig. 5, and Plate LVII. fig. 1. One of them, which reminds one of Etruscan art by the beauty of its finish, is formed by a thin plate of bronze 4¾ inches long and 2 inches wide, rounded at one end and having a blunt point bent back into a hook at the other. The rounded end has also on the lower side several hooks, intended to be fixed to the leather girdle. The upper surface is ornamented with three pairs of slightly projecting lines, two of which follow the outline and the third is in the median line of the buckle.

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[1] Dr. Th. Studer, of Bern, in his interesting account of a scientific voyage round the world, has lately mentioned several specimens exactly like our lake-dwelling discoidal stones. These stones, which had a cord passed round them in the lateral furrow, are used, according to this author, by the natives of New Zealand for fishing purposes; they attach large hooks to the cord which, being weighted by the stone, sinks to the bottom of the water.

[2] I noticed in the Museum at Mayence a leathern girdle ornamented with plates exactly like these.

b. Pins and Fibulæ.—With but few exceptions all the pins found at this station, 300 or 400 in number, were of one type, only varying in size. Some have a small head, in general flattened, and of the same piece as the shank; others have their ends rolled round on themselves so as to form a kind of handle, to which a ring is attached.

Two small bronze pins are remarkable as having been found enclosed in a kind of case made of a very thin plate of beaten bronze, Plate LVIII. fig. 11. The pin drawn Plate LXI. fig. 5 is a beautiful specimen; the type is found more frequently in the tumuli than in the lake dwellings.

The fibulæ which are so common in the iron age (at La Tène) and in the Roman period are extremely rare in our lake dwellings. Only six specimens have hitherto been found, and these all came from Möringen. They are of bronze, and are of two different types. Those of one type, massive and heavy, are cylindrical, ornamented with many projections in relief in the shape of massive equidistant rings. This cylinder is bent into a semicircular shape, and is drawn out thinner at one end, so as to form the spring and the tongue, while the opposite end is flattened and doubled back, forming a kind of hook to receive the end of the tongue, Plate LVI. fig. 2. In the fibulæ drawn Plate LVI. fig. 1 the spring has been broken and mended by a bronze wire bound round it.

The second type, or that with a curled spring, is less massive but more elegant than the last, and resembles very decidedly the fibulæ of the first iron age. The specimen drawn Plate LX. fig. 4 only differs in the metal from those found at La Tène.[1] Another, which has an expansion in the shape of a double boss or stud on the stem connecting the two ends, belongs to a group often found in the pre-Roman tombs of Burgundy, see Plate LIX. fig. 6.

c. Bracelets, Rings, Pendants, Beads of Amber, Glass, &c.—After the hair-pins the objects of dress most frequently met with at Möringen are rings for the arms and legs. Probably from 150 to 200 specimens have been found, without reckoning a number of fragments intended to be recast, and found near the moulds already described. The size varies according to the use they were intended for. The smallest, or those fitted for children, are formed for the most part of a simple oval bronze rod, and are little more than 1½ inch in diameter, while the larger ones, intended for the arms of adults, have a diameter of more than 5½ inches. These latter, Plate LXV. fig. 1, are in almost every case cast, hollow inside, and have at each end a flattened expansion like a flat button or stud, characteristic of the bracelets of the lake dwellings.[1] They are all open with the exception only of two specimens, which are entirely closed.

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[1] See those drawn Plate CXXI. figs. 2, 8, 9, and 13, which are of iron, and which were found at Marin or à la Tène.—[Tr.]

Nearly all are of bronze; only two specimens were found made of a kind of hardened wood, said to be lignite. Their ornamentation is equally uniform, and consists essentially of striæ and of a twisted or fringe-like pattern, given by casting in the mould.[2]

An exception must be made of a few specimens of a somewhat later age. They are broad oval-shaped bands, Plate LXIV. fig. 2, made of a thin bronze plate beaten out by the hammer, and ornamented externally with designs artistically engraved by the burin. They consist of rows of concentric circles, dotted in the centre, and connected with one another by a series of straight parallel lines.

One of the cast bracelets has an interesting peculiarity. On the external surface, near the terminal stud, a little hollow may be seen with irregular edges about $\frac{4}{10}$ of an inch long by nearly ⅓ inch broad; the sides of this hollow are thinly covered with a whitish metal, which seemed to me to be tin. Evidently this little chasm corresponds with that part of the mould where the metal was poured in, and it has been done by the workman who, in taking off the 'gate,' had broken away a part of the thin surface of the bracelet, and afterwards endeavoured to repair the damage by filling the vacant space with tin.[3]

Another specimen, Plate LXIV. fig. 5 exhibits an advance on the last type, as it can be opened and shut at will. It was, in fact, made of a bronze wire striated and folded back upon itself, so as to form two pieces of equal length. Then this double wire was bent into a circle, and the ends were formed into a hook, which caught in a ring or handle at the opposite end, where the two wires were folded back on each other. To this handle is suspended by way of ornament a moveable ring.

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[1] The Irish armillæ have studs or buttons at each end, but they are in general more or less cupped. See Sir W. R. Wilde's Catalogue, p. 570 (copper), fig. 479 and p. 53 (gold), fig. 586.—[Tr.]

[2] See the fragment of a bracelet mould from Auvernier, Plate LXXV. fig. 2.

[3] On carefully examining all the cast bracelets in my collection I noticed that all of them had a little defect in the same place, arising from the operation of casting, or rather of clearing after casting.

I have also to mention a pair of cast bracelets (now in the museum at Bern), ornamented externally with a series of small bands of iron inlaid in the bronze, Plate LXVI. fig. 2. Necklets or tongues are very rare at Möringen. I have only obtained one broken specimen. A similar bronze ring of large size was lately found here, Plate CC. fig. 6. It is peculiar, as it has nine thin bands of iron in three triplets placed amongst the lines which run round nearly the whole surface, and form its ornamentation.

With respect to the mode in which the arms were put into these bracelets, which had such very narrow openings (varying from $\frac{6}{10}$ of an inch to 2 inches), several explanations have been proposed, none of which seem perfectly satisfactory.

Some are of opinion that the bracelets were placed on the arms of children who kept them on till they grew up. But in this case the armlets, specially intended for children, would have been superfluous.

Others suppose that they were put upon the arms over the hand, but anyone who tries to do this will soon be convinced that the plan is impracticable.

The only other remaining method seems the most natural, and, according to my ideas, was that used by the lake-dwellers, namely, fixing the bracelet directly upon the wrist itself.

This method is perhaps a little difficult, but the elasticity of the metal would soon help, and if care was taken to draw back the flesh by degrees as the bracelet closed more tightly upon the arm, the operation would succeed perfectly even in the case of armlets with very narrow openings.

In concluding this list of articles of dress I may mention a near-pendant, Plate LIX. fig. 16, the form of which is like that of a sea-shell; also a number of rings made of very fine bronze wire.

Some armlets and pendants, Plate LVI. figs. 6 and 7, and Plate LVII. fig. 6. These consist of rings, some of which have other rings hanging from them or furnished with a variety of appliances, or of plates pierced with rows of holes, Plate LVIII. fig. 2.[1]

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[1] It seems to me that this is most probably the upper part of an ornament somewhat similar to that drawn Plate LVI. fig. 3. This specimen reminds one of a lady's chatelaine at the present day.—[Tr.]

Some convex buttons or studs, with straight shanks, or with rings to fasten them to the dress.

Several beads of glass and of amber; one of the latter is remarkable for its size, Plate LVII. fig. 5. Two double spirals exactly alike, one of which, Plate LVII. fig. 9, is of gold wire and the other of bronze. Lastly, two specimens, the use of which is entirely unknown to me—unless they were intended for children's playthings. One is a cylindrical bronze tube 2¾ inches long, with three circular hollow rings on projections at each end. The other is a kind of hollow ball, Plate LXXI. fig. 2, with a perforation quite through it, and with a cylindrical appendage like a socket. A similar specimen has been found in the pile settlements of the Lake of Bourget.

IV. OBJECTS BELONGING TO HORSES' HARNESS.

a. Horses' Bits.—If there has been any doubt of late years as to the existence of the domesticated horse in our lake dwellings, the bits found in the relic bed of Möringen, in bronze, horn, and iron, would be quite sufficient to set the matter at rest.

When the first specimen of these bits was discovered I was inclined to doubt its authenticity, and I fancied that it was a product of modern industry which, by chance, had been lost among the remains of the lake dwellings. But when my 'fisherman' (relic-hunter) assured me that he had got it by means of the scraper from the bottom of the relic bed, and when I had compared it with other objects of the same metal in my own collection, I no longer hesitated in acknowledging its antiquity, and in classing it amongst the most valuable specimens from the pile dwellings of Möringen.[1] It is, in fact, very cleverly made, it was cast in a single piece, without any trace of soldering, and is very like the bits of the present day. See Plate LXX. fig. 1.

From its dimensions one may infer that the horse of the bronze age was of small size. In fact, the bar (or that part which is placed in the mouth of the animal) is little more than 3½ inches long, while our modern bits vary in length from nearly 4¾ inches to $5\frac{9}{10}$ inches.

The side-bars, or cheek-bars, are bent in the shape of a semicircle, they are 4¾ inches long, and each of them has three fixed rings intended for the reins. The middle ring placed at the end of the bars was probably used to fix the bit in the mouth, while the rings at the extremities of the cheek-bars would hold the reins intended to guide the animal.[1]

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[1] A fragment of a bit exactly similar and found at the same settlement is in the museum at Bern.

At this station I obtained a second bit, Fig. 5, also of bronze, but unfortunately imperfect, in fact only one of the cheek-bars remains; it differs from the last in being smaller (the cheek-bar is little more than 3½ inches long) and by the absence of *metal* mouth-bars. These were probably of wood or of horn, and fixed in an opening made for this purpose in the cheek-bars. A bit exactly similar was found at Vaudrevanges by M. V. Simonde Metz, and has been described by M.A. Bertrand, in the 'Revue Archéologique.'[2]

A third bit, Figs. 2 and 2A, belongs to a more recent period. It is of iron and made on the same plan, the bars being of wood or stag's horn, similar to that just described. But the fixed rings at the end of the cheek-bars have a second moveable ring.

Besides these, mention may be made of some specimens of stag horn, Plate XLIII. figs. 1 and 10, which have always been found in pairs, and which, for a length of time, were erroneously considered as weavers' shuttles; evidently, however, they have been used for bits. They appear to be the ends of cylindrical antlers, well polished and neatly formed, 4¾ inches long; each of them has three oblong holes bored through them, the two at the ends being in the same direction, while that in the middle is at right angles to the other two. The middle opening, which corresponds with the median ring of the metal bits, was intended to receive the bars which were made of hard wood, as I have been able to ascertain from a specimen in which they were partially preserved. The reins passed through the holes at the ends, where they were secured by little wooden pegs, Plate XLV. fig. 9.

b. Phaleræ or Discs.—About a dozen of these convex discs have been found at Möringen, varying in diameter from 1½ inch to nearly 6 inches. In all probability they formed part of the harness. The small ones, Plate LXXIII. figs. 2 and 8, which are like large buttons, have been made with the hammer, and in the centre there is a conical projection, Plate LXXII. fig. 4. All of them have a kind of ear in the centre of the concave side, by means of which they could be fastened to the the harness.

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[1] Many similar bits, also of bronze, have been found in Italy, but their ornamentation and more complicated form lead me to believe that they date from a period less ancient than our lake dwellings. On this subject see the interesting work of Count Gozzadini,' 'De quelques mors de cheval italiques, &c. Bologne, 1875.'

[2] Deux mors de cheval en bronze—Möringen et Vaudrevanges, par M. A. Bertrand.

One very curious specimen, not before discovered in the lake dwellings, has some resemblance to the convex discs just described; it was probably used to ornament the head of a war horse.

It is a piece of beaten bronze, Plate LXXIII. fig. 1, very thin in shape, like the covering of a vase, but in the centre there is a round opening 1⅛ inch in diameter. The edges of this opening are strengthened by the introduction of a central and more massive ring which was fixed in its place by four rivets. The ornamentation on its external surface consists of six rows of little 'repoussé' studs, arranged concentrically. Some of them show the light through in consequence of wear. The diameter of this specimen is 5½ inches, its height is 1½ inch. This ornament must have been highly valued as it bears the marks of having been mended carefully with two rivets.

A disk, exactly similar,[1] has been found associated with a horse's bit, fibulæ, and other bronze objects in the tombs of Veruchio.

V. POTTERY, CRESCENTS.

I do not think that I am exceeding the truth in estimating the number of earthenware vessels, either entire or in fragments, found at Möringen at several hundreds. They were all made by hand without the aid of the wheel, and do not differ materially either in form or size from similar specimens found in other lake dwellings, already described in preceding reports. The smallest, Plate LXXVIII. figs. 3 and 4, are only as big as a walnut-shell, and have been used as children's playthings, or as vases for perfumes; while the large ones, intended to hold provisions, run up to 35 inches high and 29 inches in diameter. Small earthenware vessels, with three sides, and divided into two parts by a partition, have apparently been used as salt-cellars, Plate LXXVIII. fig. 7, and Plate LXXIX. fig. 5.

Some specimens in the form of plates have the bottom perforated, others are perforated laterally; these may have been used for draining honey.

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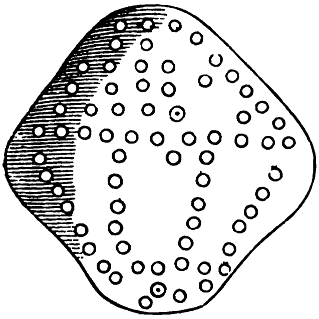
[1] See Gozzadini, De quelques mors de cheval, &c., plate xi. fig 15.

A large spreading dish, the base of which is less than 2½ inches in diameter, while the top is more than 15 inches across, is ornamented inside with geometric patterns, artistically coloured in red, which, by the fineness of their execution, remind us of the productions of Etruscan ceramic art, Plate LXXVI. fig. 1. Several of them have one or two handles; in fact, one specimen had four. The ornamentation, which is generally on the outside, consists of lines often very fine and artistically grouped, of little chevrons, of coloured triangles, of rows of points, and of raised festoons, made by the help of the fingers, surrounding the neck and the handles of the vases. One single fragment was ornamented with little plates of tin.

One vase, with a handle and of an elegant shape, still retains the marks of ownership in the shape of a small cord passed round the neck. Other specimens have at their base the potter's mark, consisting of two little furrows placed crosswise.

In the excavations made by M. de Fellenberg there were found curious earthenware rattles, Plate LXXIX. figs. 1 and 2, very like our present sheep-bells. They are little hollow balls, pierced with holes, ornamented with lines and furrows; they contain some little fragments of hardened clay. A somewhat similar rattle, of which the annexed is a woodcut, was found in a tumulus at the Hard near Basle.

FIG. 23.



Amongst the other objects of pottery, or baked clay, those which are commonly called spindle-whorls were very abundant at Möringen, for in this settlement alone between 300 and 400 were obtained of all sizes. It can hardly be imagined that they were all spindle-whorls. The smallest probably were beads for a necklace; others, which are ornamented, some of them rather elegantly, may have been personal decorations or children's toys. One, however, was used in a different manner, and as this is the first instance known amongst the lake dwellings, it has been drawn, Plate CL. fig. 9. It was in fact a needle-holder of the lacustrine age. If carefully examined six little holes may be seen placed regularly round the central perforation, each about $\frac{6}{10}$ of an inch deep, running diagonally towards the centre of the cone. In one of these there still remained a bronze needle of the usual form, and as there might be a doubt on some minds whether this needle had been introduced into the hole in later ages, it may be well to state that when the needle was drawn out the point, or that part which had been covered in the cone, was of the natural colour of the bronze, while the rest of the needle was covered with a bluish patina.

Some of the spindle-whorls are exactly of the shape of the sea-urchin or *Echinus*, and it is a curious fact that in this same settlement two recent specimens were found, viz., *Echinus perlatus* and *Hemicidaris crenulatus*. These may have been used as models by the potter.

There have been found at Möringen a dozen specimens, as well as numerous fragments, of those curious objects, made either of pottery, 'molasse,' or wood, which, from their semilunar form, have been called crescents, Plate LXXX. They vary in length from 6 to 16 inches. All of them have a flattened base, and in some cases they rest on four feet; only one side is ornamented with a variety of patterns traced with the finger on the clay while moist. They are all of one uniform and symmetrical type, the central part or the body has a projection at each side curved upwards in the shape of a semicircle, the concavity being towards the median line of the crescent.

A vertical section of the body would always be of a triangular shape, with the top rather blunt—in other words, the blunt top would be the upper edge of the crescent, and the base of the triangle would be the lower part of it.

With respect to the purpose to which these objects were applied, some authors have assigned to them a practical use, and considered them as pillows or bolsters[1] to support the

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[1] The following information as to the Egyptian bolsters has been sent to me by M. Chabas, the learned Egyptologist of Chalons:—

'The ancient Egyptians made use of a pillow or bolster formed either of wood, of schist, of earthenware, or of stone of different kinds. The name they gave to these objects was *ouls*. Thousands of specimens have been obtained, for besides those large enough to be effective they were made both of small and middle size, some to be suspended like necklace beads and others as talismans. Amongst a number of amulets which had been deposited in the tombs these *ouls* are often found of various sizes, and one of the chapters of the funeral ritual gives the formula which was used to invest them with their mystic properties. No hypothesis is necessary as to the use of the *ouls*. The same piece of furniture is still in use amongst some Nubian and Soudan tribes, who have copied the custom from the ancient Egyptians. They are used to rest the neck upon so as to keep at a distance from the ground their enormous plaited head-dress, which would have hindered them from sleeping, and which, if once put in disorder, it would have been difficult to rearrange. But this does not prove head-dress like similar objects used by the Egyptians. Others have considered them to be religious symbols, and have con-

that the lake-dwelling crescents were used for the same purpose. The measurements of those I have seen and which are of enormous dimensions seem to me but little adapted to form a bolster.'

It is very evident from the above note that Dr. Von Gross can hardly bring his mind to believe that these singular specimens were head-rests, and yet there is much to be said in favour of this view. I see no reason why they may not have formed charms or symbols connected with the crescent moon or the horns of oxen, and also have been put to a practical use as head-rests.

The reasons which have led some antiquaries to conclude that they were head-rests or pillows are—

Firstly.—The fact that the hair of the lacustrine settlers must have been very elaborately dressed, as evidenced by the enormous quantity and large size of the hairpins which have been found in the various settlements.

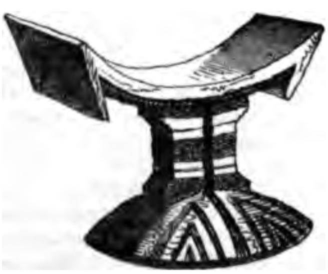
Secondly.—The fact that this very elaborate head-dress can hardly have been accomplished every day, nor could it be preserved intact without some arrangement similar to these 'rests.'

Thirdly.—It is well known that many half-civilised tribes at the present day not only dress their hair very elaborately, but use very long hairpins, just like those of the lake settlers, and to save trouble use these pillows or head-rests to avoid the necessity of a daily toilette. I am informed by Colonel W. Goodfellow, C.B., R.E., that the Somalis, a tribe of Africa, on the opposite coast to Aden, use hairpins 8 or 9 inches long, and he obtained for me from his brother, Major G. R. Goodfellow, of the Bombay Staff Corps, sometime British Political Resident at Aden, the following note respecting the head-rests used by this tribe :—

'While at Aden I collected amongst other curiosities the combs and wooden pillows or head-rests used by the Somalis, a tribe from the coast of Africa, opposite to the British settlement of Aden. The Somali is quite a dandy in regard to dressing his hair, for having no whiskers or beard to speak of, and only a flowing white robe for raiment, his peculiar head of hair is most remarkable, more like a mop than anything else. This curious wig is always dyed by being plastered with lime. When this coating of lime is removed and the head washed, numerous clusters of long woolly curls are released, the whole head is then anointed with oil or clarified butter; a hard wooden pin, about 8 or 9 inches long, with two or three prongs, being used to dress he hair, and induce the crisp little locks of wool to separate.

'In resting or sleeping, to keep the head off the ground when oiled or saturated with lime (for it is usual to allow the hair to remain in pickle for some time), the Somalis use a peculiar shaped wooden pillow, made somewhat in the form of a crescent, on a stand high enough to take the back of the head when the body is reclining.'

Fig. 24.



Two of the head-rests referred to have been most kindly presented to me and are now in my possession; one of them is sketched in the annexed woodcut. The two ends of the segment of the circle are 7 inches apart, and the lowest part of the curve is 5¼ inches from the ground.

Lastly, I would mention that the peculiar lengthened form of some of these crescents appears to indicate that whatever may have been their origin or symbolism they were actually put to some practical purpose, see Plate LXXX. Fig. 10, in which the distance between the horns is very considerable, and the projections at the two nected them with the worship of the moon, which ascends to the highest antiquity.

And yet if we look over Plates LXXX. and LXXXI., which contain sketches of all the principal types hitherto found of these moon images, we shall be struck by the resemblance which some of them, Figs. 3, 7, and 8, have to the upper part of an ox's head, and one feels disposed to ask whether these objects may not possibly have originally been coarse images of that animal which were gradually modified into their present form.

Moreover my opinion is in a measure confirmed by the discovery made last autumn in the stone age station of Lutz, of an ox's skull, quite perfect, and still having a cord attached to it, apparently intended to hang it up as a talisman[1] in some part of the hut.

VI. SUNDRY OBJECTS.

1st. A wooden staff, Plate LXXXIII. fig. 2, rather more than three quarters of an inch in diameter, ornamented with most varied patterns. It may have been the handle of some weapon used for parade, but in fact its use cannot now be ascertained. In the seventh report this specimen was by mistake said to have been found at Auvernier.

2nd. A curious implement made of yew wood, probably used as a netting needle, Plate LXXXIII. fig. 5. The handle is large and broad; at the end of the thinner portion, or pin, there is a barb, probably to assist in making nets.

3rd. A stone neatly worked and perforated for suspension.

4th. Two specimens made of stag's horn. One of them is flattened in shape, Plate XLIII. fig. 6, and is ornamented with little circles, having a point or dot in the centre; the other, Fig. 8, is cylindrical, and has most probably formed the handle of some implement.

In order to make the account of Möringen more complete the following antiquities from this settlement, which are not mentioned in the report of Dr. Von Gross, have also been drawn.

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ends give no sort of idea either of moon or horns. I do not venture to express a decided opinion, but it seems to me that the above arguments on one side of the question ought to have considerable weight. See also the note on page 338 of the present volume.—[Tr.]

[1] According to M. Bonstetten this custom of placing the skulls of oxen as talismans on the top of the roof had still been observed in some villages of the Canton of Bern, and was only a reminiscence of the lake-dwelling age. See Dr. A. Lahn Die Blüthezeit des Bronzealters, &c. Bern, Jont, and Reinert, 1875, p. 15.

Plate XLII.	Fig. 12.	'Stiletto,' or pointer of stag's horn.
„ XLV.	Fig. 12.	Ornament made of a boar's tusk.
„ XLVI.	Fig. 7.	Ferrule (?)
„ XLVII.	Fig. 5.	Spear or javelin head.
	Fig. 11.	Bronze arrow-head.
„ LV.	Fig. 2.	Bronze chisel.
	Fig. 8.	Bronze hammer.
„ LVIII.	Fig. 4.	Bronze spiral.
	Fig. 5.	Ornamented bronze plate.
	Fig. 15.	Dish with handle.
	Fig. 17.	Specimen; use unknown.[1]
	Fig. 18.	Gold finger-ring.
„ LIX.	Fig. 3.	Bronze ear-ring.
	Fig. 4.	Bronze finger-ring.
	Fig. 7.	Bronze fibula.
	Fig. 11.	Bronze twisted rod.
	Fig. 14.	Bronze chisel.
	Fig. 18.	Round bell.
„ LXII.	Fig. 1.	Armilla.
	Fig. 2.	Ditto.
„ LXIII.	Fig. 4.	Fragment of an armilla.
	Fig. 5.	Ditto ditto.
„ LXVI.	Fig. 3.	Armilla or ear-ring.
	Fig. 4.	Ditto.
	Fig. 5.	Armilla.
„ LXVII.	Fig. 6.	Ditto.
„ LXXII.	Fig. 3.	Phalera or disc.
	Fig. 5.	Ditto.
„ LXXIII.	Fig. 4.	Ornamental ring with five loops.
	Fig. 6.	Part of an ornamental chain.
	Fig. 11.	Disc.
„ LXXV.	Fig. 6.	Fragment of a mould for a celt.
„ LXXIX.	Fig. 3.	Child's toy.
„ LXXXIX.	Fig. 2.	Bronze celt, hafted with wood.
	Fig. 6.	Bronze ring (? ear-ring).
	Fig. 10.	Fragment of pottery.

„ CC. Fig. 6. A bronze ring, lately found, ornamented with numerous lines, encircling the body of the ring. The peculiarity of this specimen is that some of these lines are inlaid with *iron*. The three triplets drawn black in the sketch consist, in fact, of inlaid iron.

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[1] Possibly part of a drill.—[Tr.]

Notices of the Excavations of the Lake Dwelling of Möringen by M. E. de Fellenberg.

Now that the Lake Drainage Commissioners have carried on their works regularly from year to year, the difficulty in examining the lake dwellings of course diminished as the level of the water fell; and when it had gone down about five feet, and the station at Möringen was only about three feet below the surface, many fishermen found it more lucrative to collect relics than to follow their usual occupation, and, in the years 1871 and 1872, half a dozen or more boats might be constantly seen anchored over the station, searching the lake-bottom for antiquities.

But, when the Government had made good its right to the foreshore, it was compelled, on account of the wholesale removal of the antiquities, some of them to foreign parts, to forbid this mode of working, and to undertake explorations on its own account in the interest of science. The present reporter was commissioned by Government to superintend the excavations, and this station was examined, first by Mr. Jenner in his absence and afterwards by himself.

The excavations began in the autumn of 1873. When the lake was at a higher level than at present, the settlement was about 900 feet from the shore, and in the middle—on the highest part of the so-called 'Steinberg'—the water was 8 or 9 feet deep. The great sheltered bay, and the gradually sloping bottom between the shore and a sand-bank which broke the force of the outer waves, made the situation extremely desirable for a lake dwelling, as it was protected from the dangerous mountain wind called 'Jorant,' and had a ready communication with the open water both east and west.

The settlement communicated with the mainland by a bridge 600 feet long, which must have been nearly 20 feet broad. This may be proved by the poles still remaining. There is a double row of them about 10 or 12 feet apart. These poles are not at perfectly regular distances from each other, but stand chiefly in pairs, two or three feet apart. Near the shore all traces of the bridge are lost in deposits of mud and gravel. The direction taken by the bridge is east-north-east; it runs to a quiet hollow or valley near Lattringen, so that the settlers had convenient access to their fields and hunting-grounds.

Hitherto only objects of the bronze age and the early part of the iron age had been found at Möringen, but it was proved by the investigations of Mr. Jenner that between the bronze age station and the shore, in fact about 450 feet from the latter, there was a smaller lake dwelling of the stone age. The piles of this small station stand in regular rows, but they are exceedingly rotten, and have decayed away nearly even with the bottom of the lake. They are chiefly of white wood, but with some few exceptions of oak, and are of smaller size than those of the other settlement; they are badly pointed, or hardly pointed at all, and only project from 3 to 5 inches from the bottom; while those of the bronze age station, now dry, project 1½ or 2 feet from the ground. The latter are chiefly of oak, very hard, and very black.

The little stone age station just referred to is oblong in shape, from 300 to 400 feet long, and from 80 to 100 feet broad. At the east end there is a small steinberg, 100 feet long and 80 feet broad, made of gravel and broken stones. The bridge from this stone age station ran directly south to the shore, and even now a double row of piles may be seen—that is, a row of single piles on each side, not of double piles as in the bridge of the bronze age settlement. The piles are from 5 to 8 feet apart, so that they indicate a narrower, weaker, and less effective connection with the shore than the bridge of the bronze age.

The general form of the great lake dwelling of Möringen, so far as it can be decided, for part is still covered with water, is that of an ellipse, the longer axis, from north to south, being about 550 feet long, and the shorter axis, from west to east, about 350 feet.

After these general remarks, we will first give the substance of Mr. Jenner's report as to his excavations in October 1873, and then add the account of my own subsequent explorations:—

Mr. Jenner reports as follows:—'On the 2nd October, 1873, I began the work with two men where the ground had been laid dry, and where many piles were to be seen, but finding no trace of the relic-bed, I was convinced that it had here been washed away by the waves, for this was the place where the rich collection of bronze objects in the late Colonel Schwab's collection was obtained, which must have been laid bare and collected when the water was still. On the land side of this lake dwelling nothing was obtained but a few stone celts and flint chips; no bronze objects.

'The area yet to be explored lay between the present shore and a little sand-bank which made its appearance after the water had been lowered. It was here that the antiquity-hunters obtained the moulds which were found just before the Government prohibited further working. This seemed the place to begin, so I made here a "water chamber"[1] of a square form near the island, making use of the island for one of the sides. We had to make a bridge 370 feet long for the convenience of reaching the island, and we used for this purpose the best piles from the station itself; crosspieces were then nailed on, and the whole was covered with boards.

'In this first water chamber the relic bed was met with 2½ or 3 feet deep, under the sandy bottom. A great deal of pottery was found, the major part of which was unfortunately of no value; also a portion of a human skull and some bronze implements.

'The second "water chamber" was placed alongside of the first, so that only two sides of the square had to be made, as the first water chamber and the island above mentioned formed the other two.'

Such is the substance of Mr. Jenner's report. When he left I undertook the superintendence, and it seemed to me best to continue the plans of my predecessor, and to go on adding one water chamber to another. In the first which I made the relic bed was found, only half a foot beneath the covering of sand. Where the mud machine had been previously used, the bed consisted of a mixture of stones, sand, and the remains of wood and pottery. On the inner or land side the relic bed was half a foot thick, and was composed of a yellowish-brown mud-like accumulation of rotten wood and interlaced masses of twigs of all kinds, mixed with round timber, lying horizontally, some unhewn, and others showing traces of having been worked. Where the relic bed had been undisturbed it was very hard to dig through, so firmly were the vegetable remains interlaced with each other, and mixed throughout with bones, pottery, and indications of a conflagration. The vessels of earthenware, even when perfect, were so very soft that it was difficult to exhume them whole out of the relic bed; the best plan is, when the

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[1] Apparently what in England is called a 'cofferdam,' which enables works to be carried on in the dry inside although beneath the level of the water outside.—[Tr.]

'water chamber' becomes dry, to remove the covering from the relic bed, and then to undermine it so that it falls and breaks by its own weight, and the specimens can then be picked out. All the bones, plants, and seeds were carefully preserved; the two latter have been placed in the hands of Dr. Uhlmann for examination. (See Dr. Uhlmann's report appended to this notice.)

The results of the fifth 'water chamber,' or the first on the land side, were very satisfactory. On the outer side the relic bed was from 8 inches to 1 foot thick. Bronze celts, rings, and hairpins were found here, and the quantity of broken pottery was prodigious. Some perfect vessels were found standing upright, others turned upside down, and, in fact, lying in all directions.

The sixth water chamber was made by the side of the previous one; here the relic bed on the outer side was a foot thick, and the results of the exploration were very good:—A large piece of wattle-work, still holding together, and made of birch and alder branches, which had probably been the covering either of the wall or the floor. A piece of round wood was also found here, about 6 inches in diameter on the average and 7 feet long, into which another piece was accurately mortised. Many of the boards found were burnt.

The next 'water chamber' was made towards the land side, in order to ascertain how the relic bed ran out, and we laid it out longer and narrower; the water here was 7 or 8 feet deep. Mr. Jenner's ideas were fully borne out. On the south side of the 'water chamber' towards the land the relic bed was in some places only 2 inches thick, but very rich in antiquities, which are not described here as they have been fully treated in this volume by Dr. Von Gross.

The results of these excavations are as follows:—We have proved that the relic bed is entirely wanting in more than a third of the whole settlement towards the land side, having been washed away by the waves. The piles are pointed conically for 3 or 4 inches from the end; they are nearly all of oak, almost as black as ebony, and may still be easily worked; their diameter is from 4 to 8 inches, and they are not placed with much regularity.

In three different places in the settlement the piles were counted, each of these areas contained 2,500 square Swiss feet, and in these areas there were 150 piles in that to the east, 165 in the middle, and 145 in that to the west, so that they were pretty evenly apportioned, on the average 153 piles to 2,500 square feet. Now, if the whole station is 500 feet long by 340 feet broad, the area would be 170,000 square feet, and, at the above rate, the whole number of piles would be 10,400, but we must further bear in mind that in that part of the settlement where the water is deeper the piles are more numerous.

The exploration of this settlement was resumed in the spring of 1874, as the level of the lake had fallen so continuously that the greater part of the station at Möringen had been laid dry; and as the work in consequence advanced more quickly, we had by the middle of May dug up the whole space between the water chambers described above and the sand bank. On the outside of the last made water chamber the relic bed was 2 inches in thickness, but near the sand bank it ran out, becoming thinner and thinner, till at length nothing was to be seen but a black stain on the lake-bottom. A considerable portion of the relic bed, where thicker, had been disturbed by the early search for antiquities above-mentioned made by the mud machine. But under those parts of the settlement where, for various reasons, we imagined the huts to have been situated, and where the relic bed seemed in its natural state, it contained bones, pieces of pottery, corn, and other vegetable remains, while beneath what seemed to have been the outer platform, there were but few bones and pottery, and the objects of bronze were exceedingly rare. On the other hand, there were numbers of wooden posts notched at the top, into which cross-posts could be fitted. These we imagined might belong to a weaving machine. In the same place were found numbers of wooden implements (if they can be called so), from 2 to 20 inches long, sharpened and also charred at both ends. As these were very numerous, and all similar, they must have had some technical use. Some antiquaries have considered them to be the stems of distaffs or spindles, and most certainly the large number of spindle-whorls found at Möringen seems to favour this explanation; others think that they had been used to produce fire, as several savage nations now do, by being turned rapidly round in a slab of wood. A very large number of burnt boards were found, especially near the large bridge; they are from 5 inches to 2 feet broad. Some of these boards had square holes cut in them, and some were pointed, but nearly all had been worked in one way or other. A quantity of round timber and piles, also burnt, were found here, together with some burnt basket and plaited work.

The relic bed under the platform on the west of the station is very different; it is there 4 feet below the surface of the bottom and is covered with sand. Here we found a broad frame made of wooden beams more than 20 feet long, and from 3 to 6 inches broad, lying horizontally. It was made chiefly of young oak stems, which had been roughly hewn with celts, both above and below. Underneath this large frame there was but little pottery, no bones, and not a trace of corn, fruits, or other vegetables; but on the other hand, somewhat singularly, some very good bronze implements, such as armillæ and the blade of a bronze sword bent back.

Near this place were found the remains of a foundry for bronze, described previously in this volume by Dr. Von Gross.

On the whole the work carried on in 1874, with from five to nine men employed, was not very productive, at least, three-fifths of the area had previously been worked by the mud machine, so that all we could obtain was a scanty gleaning. Most of the specimens found have been described by Dr. Von Gross in the previous part of this volume, so that it is unnecessary to mention them again; but as a close to this report I may refer to some natural objects which the settlers must have collected on their wandering or hunting expeditions as curiosities. Thus rock crystal was found, both in pebbles and crystals; in the latter case they were in general broken. Fossils from the Jura and the 'molasse' were also found, such as fossil oysters and *Terebratulæ,* and also a very pretty 'druse' of crystallised carbonate of lime, which must have been troublesome to hammer out. All these had evidently been brought here by the settlers as curiosities.

On the Remains of Plants from the Lake Dwelling of the Bronze Age at Möringen on the Lake of Bienne, by Dr. Uhlmann, of Munchenbuchsee.

I. INVESTIGATION.

In the autumn of 1873 some well-arranged excavations were made in the above-mentioned locality, and in the course of the winter I received for examination from M. Edm. de Fellenberg (Conservator of the Antiquarian Museum in Bern), a quantity of somewhat moist, black, peaty (muddy) earth, mixed with burnt matter. For many days I worked very patiently, and spread out this mass in small portions on white dishes that nothing might escape me. The smallest objects of interest were then picked out with the brush.

The plant-remains are found in two different states, either lying embedded in clay, mud, or sand, frequently pressed flat, like the refuse of sweepings, but not burnt. They are generally in good preservation, and when picked out still retain the appearance of having been buried in the mud ages ago; or else as grain, seeds, and fruits in a burnt condition lying in a confused mass, amongst the remains of conflagration found in the relic bed. In both cases the fine microscopic characters are often quite distinctly preserved.

II. DETERMINATION.

I.—*Eatable wild fruits.*

1. Crab (*Pyrus malus sylvestris*, L.) Burnt halves; pips or seeds, unburnt pieces of the cores.

2. Oak (*Glandes quercus*, L. or *Q. robur*). Burnt half-acorns without the shell, small acorns entire, unburnt acorn cups, remains of leaves and wood.

3. Beech (*Fagus sylvatica*, L.) Parts of the nuts, unburnt buds, bark, &c.

II.—*Eatable wild fruit-bearing shrubs.*

4. Hazel nut (*Corylus avellana*, L.) Whole nuts, both longish and round, fragments, remains of wood and bark.

5. Sloe (*Prunus spinosa*, L.) Entire fruit burnt, and numerous unburnt sloe stones.

6. Varieties of *Rubus*—parts of the fruit and seeds unburnt. Of the raspberry, *Rubus idæus*, L. Bramble, *Rubus fruticosus*, L. Dewberry, *Rubus cæsius*, L.

III.—*Eatable cultivated vegetables, all burnt.*

7. Celtic field-bean (*Faba vulgaris, celtica*, Heer).

8. Field pea (*Pisum sativum*, L.) of three sizes; var. *major*, var. *media*, var. *minor*.

9. Lentil (*Ervum* or *Vicia*). Roundish, often pressed flat.

IV.—*Corn, all burnt.*

10. Barley, of two kinds. (*a*) *Hordeum hexastichum sanct.* Heer. Parts of the spikes, and many grains with the husks attached. (*b*) *Hord. hex. densum*, Heer. Large swollen grains, partially burnt, apparently only roasted. (*c*) Small starveling grains, chiefly of the variety (*a*).

11. Wheat (*Triticum vulgare compactum*, Heer). Rare.

12. Emmer, or two-grained wheat (*Triticum dicoccum*, L.) Very pretty little bits of the spikes, small spikes and husks, burnt grains, also small starveling grains in abundance.

13. Oat (*Avena sativa* ?) Somewhat doubtful; very rare.

14 and 15. Millet and panicgrass (*Panicum miliaceum*, L. and *Setaria italica*, L.) Mixed; lumps of the seeds and many loose small grains.

V.—*Other useful plants.*

16. Flax (*Linum*). Seeds burnt, swollen, roundish, puffed out by the oil within when burnt, or unburnt and pressed flat. The first seem to agree with *L. angustifolium* Huds. The latter rather to *L. usitatissimum*, L. This plant was used for spinning, for oil, and partly also as food.

17. Garden poppy (*Papaver somniferum*, L.) seeds. It was used for oil, as a medicine, and perhaps as food.

18. Clematis (*Clematis vitalba*, L.) growing wild. A creeping, shrubby plant with a woody stem; portions of the stem were used for basketwork. This is new in the lake dwellings.

VI.—*Weeds.*

A.—Various kinds of grass, all burnt:—

19. A kind of oat, doubtful whether *Avena sativa*; parts of the spikes and grains, probably new.

20. Couch grass (*Triticum repens*, L.) Well-preserved spikes in the part where the seed lies (new).

21. 'Darnel' (*Lolium temulentum*, L.)

22. Soft Brome grass (*Bromus mollis*, L.) probably from a dry barren situation (new).

23. *Bromus* sp., doubtful whether *Bromus sterilis*; very like it.

B.—Field weeds:—

24. Wild mustard or 'Charlock' (*Sinapis arvensis*, L.) Chiefly unburnt (new).

25. *Brassica* sp. Small seeds, probably of a wild species.

26. Wild shepherd's purse (*Thlaspi arvense*, L.) new.

27. *Geranium*. Probably *Ger. dissectum*. (?)

28. Light grey goosefoot (*Chenopodium album*, L.)

29. Spreading *Orache* or goosefoot (*Atriplex patula*, L.)

C.—Marsh Plants:—

30. *Scirpus* sp. Small rush stalks fastened together in little bundles.

31. Muricated sedge (*Carex muricata*, L.) Seeds (new).

32. *Carex* sp. Several sedge seeds of different species.

33. Water mollugo (*Malachium aquaticum*, Fries). Like wormwood.

34. Water ranunculus (*Ranunculus aquatilis*, L.)

35. Creeping ranunculus (*Ran. repens*, L.)

36. Bur-reed (*Sparganium ramosum*, L.) Buds, burnt, probably new; also buds of shrubs and some undetermined seeds.

VII.—*Cryptogamous plants.*

37. Ferns (*Pteris aquilina*). Fragments of the leaves.

38. Moss (*Neckera crispa*, L.)

39. Fungi (*Polyporus igniarius*). Fire fungus, burnt fungi.

Thus at Möringen, up to the present time, we know of thirty-nine species of plants. Of these about ten are new in the lake dwellings. There are about a dozen cultivated species and twenty-eight kinds growing wild.

More than sixty specimens mounted on glass, either dry or in liquid, or in balsam, have been transmitted to the Archæological Museum in Bern to be preserved there.[1]

III. RECAPITULATION.

The seeds found in the droppings of animals show us that they were domesticated, and were at least partially confined to the lake dwellings, and probably grass, hay, and weeds were used both for their fodder and bedding. The chrysalis shells of the different kinds of flies show this also, as well as the droppings of domestic animals before alluded to, and the manure which, as it appears, fell into the lake on the very spot.

The fact that many of the vegetables were in a burnt state proves that they were actually stored in the lake dwellings at Möringen when that settlement was destroyed by fire.

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[1] In the lumps of dried mud sent to me for examination, I found the burnt chrysalis shells of several kinds of flies, and a number of well-preserved fish-scales from cyprinoids, chiefly burnt; besides this, also burnt droppings of animals, many of them like beans in appearance, probably of lambs, and one specimen of cow-dung. To assist me in the determination of these objects I referred to a collection of vegetables from the different lake dwellings, chiefly of the older period, and also to a collection which has been gradually increasing for years, of all the seeds and small fruits of the herbs, weeds, and plants which grow wild in our districts at the present day.

The only fruit found was the wild crab apple, and this shows us that there was no attempt at anything like horticulture.

Most of the different kinds of wheat are rather small, and indicate a low state of civilisation, and they betoken also that their fields were forest ground, but lately enclosed and indifferently manured. There are but few exceptions, such as the large grains of barley, the thick-grained wheat, the peas, and the celtic field beans, which indicate the beginning of a little more attention to husbandry.

The corn was often only slightly burnt; this was more especially striking in the case of the larger grained barley, from this we might conclude that a large proportion of the corn had been intentionally roasted and then stored for food. This agrees with several facts recorded of the inhabitants of Palestine. Leviticus ii. 14; xxiii. 14; Ruth ii. 14; 1 Samuel xvii. 17.

The corn found here and the cultivated vegetables were exclusively spring sown.

The Romans had winter corn, and grew hemp and a large variety of vegetables (Heer), together with cultivated fruit-trees (Strabo). The want of these in the bronze age settlement of Möringen indicates an older period for the existence of this station, which would go far to corroborate our observations that there had been no communication between the Romans and Helvetia; and as the history of our country is silent as to the existence of these dwellings, their date may be safely set down as considerably earlier than the Christian era.

NOTES ON THE LAKE OF BIENNE.

By Dr. Von Gross.

Without attaching an undue importance to the pile settlements of the lake of Bienne, which possibly might be objected to by some antiquaries, it cannot be denied that the recent researches amongst them have brought to light new facts, and have thus largely contributed to elucidate several problems concerning the origin, the customs, and the manners of the primitive races who at that time occupied the shores of our lakes.

In order to prove this, it is only necessary to glance at the splendid specimens of celts made of nephrite or jadeite which have been found at Lüscherz, or at the bronze and iron swords, the implements belonging to the harness and the working utensils of the founder which have been discovered at Möringen.

Possibly it may be asked how it happened that stations so rich in the remains of human industry have not previously been made the object of regular excavations, and why (with the exception of Nidau, which, being so near Bienne, was long since investigated by Mr. Muller and the late Colonel Schwab) nearly all the numerous settlements of the lake of Bienne have remained unexplored, nay, some of them were hardly known to exist.

The chief cause of this neglect appears to have been the depth of water above the settlements, which in fact was from 3 to 6 feet above the pile-work of the stone age, and from 6 to 16 feet above that of the bronze age.

It was early in the year 1872, when the waters of the lake had become much lower in consequence of the works undertaken to drain the marshes, that the different pile settlements successively came to light. At first those of the stone age appeared, and afterwards those of the bronze period.

With respect to the appearance above the water of the different stations of the stone age, I think a certain chronological order may be observed corresponding with the age when these settlements were inhabited. In fact I have remarked that the oldest stations were still covered with water when those of a later date had for some time been laid dry. Thus the pile dwelling of Schaffis (Chavannes), which, from the primitive implements found there, has been considered as the oldest in our lake, was laid dry long after the other and later settlements had been worked. Now, to explain this phenomenon, we have the choice of two hypotheses. Either the earliest inhabitants of our country, wishing to shelter themselves as much as possible from the attacks of wild animals, built their abodes at a greater distance from the shore than their successors; or, the huts were all originally constructed at the same depth of water and then afterwards, in the interval between these two ages, the water rose to a higher level.

If the second hypothesis be the true one (and this is quite admissible), it might in this way be possible to determine the relative ages of the different stations of the stone period according to the depth of water which covered the piles.

The facts that the excavations were now made on dry ground, and that the relic bed could be studied in its original state, led to the hope that some certain indications might be obtained as to the form and size of the huts. Unfortunately this has not proved to be the case, and nothing more has been learned from these researches amongst the settlements in the lake of Bienne than the imperfect results already obtained from the dwellings found in the peat bogs.

If we look at the respective positions of the numerous pile settlements we are about to describe, it is singular to notice that nearly all (with the exception of those of Douanne and Chavannes) are arranged on the right bank of the lake; here, in fact, the roadsteads are sheltered and the shallows extend for a considerable distance; the shores are formed of low wooded hills, and thus are much more fitted for pile dwellings than the opposite bank, where there is a much greater depth of water, and where the mountains bordering on the lake are steep. One fact surprises us: it may be asked why the lake settlers, who took so much pains to construct places of shelter on the shores of our lakes, made no use at all of the natural shelters in the neighbourhood? Thus the spacious caverns of Hohle Loch above Douanne and of the Trou de la Beaume near Neuveville were carefully examined by M. de Fellenberg and myself, and we were unable to discover the least trace of prehistoric dwellings.

THE LAKE DWELLING OF LÜSCHERZ. (LOCRAZ.)

By Dr. Von Gross.

The pile settlement here of the stone age is nearly four acres[1] in extent, and is situated in front of the little village of Lüscherz. It was probably known to the late Col. Schwab, at least the name stands in the archæological map given in the first edition of this work, Plate LVI. (now in the present edition Plate CV.); but the depth of the water and the distance from the town of Bienne made excavations at this station somewhat difficult. It was not until Dec. 1871 and Jan. 1872 that, in consequence of the lowering of the lake, a part of the settlement was brought to light, systematic excavations could then be carried on with but little difficulty.

At first only a small number of workmen were employed; but when the villagers saw how easily they could turn into money the fragments of stags' horn and stone celts, everybody hastened to secure a share, and for about four weeks men, women, and children set to work and rummaged the relic bed, until at length this was stopped, and digging was prohibited by the Bernese Government, which before long took the work upon itself, and M. Edm. de Fellenberg was appointed the director.

The geognostic bearings of this pile settlement, ascertained by vertical sections taken at different points, are as follows:—The upper bed, composed of sand and mud mixed with gravel, is from 2 feet to 5 feet thick, increasing in thickness for some distance from the shore. Remains of early human industry are rarely found in it. The second bed (the relic bed) is also formed of a sandy clay or loam, very much blackened by the quantity of organic remains and vegetable matter contained in it; it varies in thickness from 4 to 20 inches. Below this is found the original bed of the lake, consisting of a clayey earth, filled with pebbles and shells; into this bed the points of the piles had been driven. These piles, which are of oak, fir, and birch, are for the most part whole stems only occasionally split, and driven into the mud without any regularity. In some places I met with several rows of them laid side by side at a regular depth; these apparently have formed part of the flooring or esplanade of the huts.[1]

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[1] All the measurements of the different settlements in the lake of Bienne are borrowed from the report of M. de Fellenberg, and were taken by Mr. F. Combe, the engineer for the 'Correction des Eaux du Jura.'

The following book may be consulted on this subject:—'Bericht an die Tit. Direction der Entsumpfungen über die Ausbeutung der Pfahlbauten des Bielersees in den Jahren 1873 und 1874.' Bern, Haller, 1875. It will be seen subsequently that considerable extracts have been made from this volume.

The excavations carried on at various times both by M. de Fellenberg and by myself from Jan. 1872 up to the present time have brought to light many remains of primitive industry, which will now be described.

I. POTTERY.

A greater number of unbroken earthenware vessels have been found here than in any other lake dwelling of the stone age. Up to the present time about thirty specimens have been secured in perfect preservation. With some rare exceptions, made of fine and purified clay, and in shape similar to the pottery of the bronze age, the greater part are formed of coarse clay mixed with small flinty gravel and burnt but slightly in an open fire. The colour is grey with a reddish tinge; the form and size vary according to the uses for which they were intended.

Some have the form of plates with the edges but little raised; others are cylindrical, and for the most part have projections perforated for suspension, Plate LXXVII. figs. 1 and 4. One specimen, which appears to have been used as a cup, is interesting, as it has the rudiment of a handle. Another with a regular handle is in form like two cones united at their bases, reminding one very decidedly, by its shape and fineness, of the pottery of the bronze age, Plate LXXVII. fig. 2.

The ornaments found on some few specimens consist of little indentations or wavy projections placed all round the edge of the vessels. In one single case lately found the external surface is ornamented with chevrons made by the finger-nail (Fig. 5).

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[1] This might be considered as the proper place to give extracts from the reports of Mr. E. Jenner and M. de Fellenberg as to the mode in which the excavations were carried on; but on the whole it seems best to give the account of Lüscherz, contained in the seventh report of the Zurich Antiquarian Association entire, and then to supplement it with any extracts from the above reports which may throw light upon the subject.—[Tr.]

II. OBJECTS OF STONE.

Several hundreds of celts have been found in the settlement of Lüscherz; they vary in length from 1½ inch to more than 9 inches, and all of them have been worked and polished with the greatest care. Some few specimens are pierced with a hole to receive the handle. The majority are made from indigenous rocks (serpentine, gabbro, diorite, and saussurite); about thirty specimens only were made of jadeite and nephrite.[1]

Amongst the latter several are worthy of especial attention. One of jadeite, the largest hitherto found amongst the lake dwellings, measures 8½ inches in length and is 2¾ inches wide. It is of a beautifully clear green colour, speckled with yellowish spots, and the cutting edge is quite perfect. Its weight is nearly 1 lb. 14 oz. English, and its density is 4.364.[2]

One other specimen, rather smaller (about 6 inches long), worked and polished on every side with greater care than the last, is entirely translucent. The weight is about 12½ oz. English, the density 3.348. In some more recent excavations I have again been fortunate enough to secure from the relic bed two magnificent specimens made of foreign stone. One is of nephrite, 4¼ inches in length, in shape like a long chisel, and of a beautiful emerald green colour. It was still fixed in a hafting of stag's horn. The other is of jadeite of a greyish green tint, and remarkably transparent; it is 6¼ inches long and its density is 3.34.[1]

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[1] On the subject of nephrite and jadeite it will be well to refer to the very interesting work of Professor Fischer, of Freiburg, in Baden, who has brought together an enormous number of facts relating to these minerals. The work, which is illustrated with numerous woodcuts, is entitled, 'Nephrit und Jadeit nach ihren mineralogischen Eigenschaften.' Stuttgart, E. Schweizerbart, 1875. With respect to the nephrite celts of the Swiss lake dwellings the reader is referred to page 352 of this valuable book.

[2] Professor De Fellenberg has been occupied in analysing all the nephrites and jadeites hitherto found in the different settlements of the Lake of Bienne. When communicating the results of his analyses this eminent chemist of Bern wrote to me as follows, respecting the origin of these celts of foreign material:—

'Although the number of these jadeite and nephrite hatchets may be small compared with those made from native stone, it is yet equally certain that their presence here indicates an immigration of the races who have left these remains behind them; for nephrite is only known as an indigenous stone in Turkestan, and in Siberia, near Lake Baikal. Jadeite comes from the province of Kiang Si, in China, south of Nankin, where it is obtained from a mountain called by the Chinese Ion-sin.

'Now how are we to explain the presence in our lakes of stones which have come from such a distance. Evidently only by the gradual immigration of the races who made use of them, and who, when driven from their primitive homes by people who took possession of their lands, were obliged to seek for an abode elsewhere, taking with them their most precious commodities, namely, the axes made of nephrite and jadeite. I am quite ready to admit that these migrations from the east to our districts must have taken a great length of time—generations, perhaps even centuries, and that a long lapse of ages would be required before these hatchets could reach the lake of Bienne. Is it not both natural and probable that these races may have made similar celts in imitation of them, although, perhaps, less carefully worked, of such hard stones as were within their reach? It seems to me that the idea of commercial relations between our country and the East by people who did not even know the use of metals, still less the art of writing, ought to be laid aside as a simple absurdity.'

I found no fragment of either of these minerals in the rough, so that we must consider that these celts were brought from the East ready made and polished as we find them at the present day.

If the station of Lüscherz is remarkable for the number and beauty of the stone celts found there, it is otherwise with respect to the flint implements. With the exception of some lance-heads, the largest of which is six inches long, and a number of arrow-heads, only small flakes have been found which had been used as scrapers or knives. No specimen (save the nephrite chisel already referred to) was found hafted either in wood or horn.

As a close to this list of stone objects, which are especially worthy of notice, I may mention some rounded pebbles, of the size of a nut or small pigeon's egg, surrounded by a covering of birch bark, and placed in a row one after the other like peas in a pod, Plate LXXXIII. fig. 7. Up to the present time these objects have only been found at Lüscherz. What can have been the use of them? It is somewhat difficult to answer this question, and yet they may possibly have been used as net weights.[2]

A dozen small discs were found perforated in the centre, so as to be used for spindle-whorls or weights, some of them had still the wooden rod or stem which completed the implement.

Several small counters of siliceous stone and a little slab of alabaster are perforated, so that they may have been worn as ornaments for a necklace or as amulets.

III. OBJECTS OF HORN AND BONE.

Amongst the multitude of implements of stag's horn found at Lüscherz the larger proportion consists of the ends of antlers bevelled to a sharp point, or hollowed at their base so as to receive a stone celt. These haftings (of which probably 600 or 800 specimens were found) are of two distinct types. Some are short, made out of that part of the horn which is nearest the crown or rose piece; these were used for hafting the large stone celts. Others are narrow and longer, and are made of the ends of the antlers; these were used for the smaller celts and cutting implements. Two of these haftings are perforated transversely, into which a peg or plug might be driven to fix the hafting firmly into the piece of wood forming the handle. I have found several of these haftings in different stages of their manufacture; some are overwrought and coarsely cut into shape; others have at their base a little rounded opening, which when afterwards enlarged would form a cavity for the celt. The celt itself was only put into the hafting as a trial, and was only hafted firmly when properly sharpened and polished. The greater part of these haftings were in their turn fixed into a wooden handle, several specimens of which have been found, Plate XLII. fig. 3. Only the larger celts were fixed at once into their wooden handles, without the intermediate hafting of stag's horn. One remarkable specimen, to which nothing analogous has been found except in the caves of the reindeer age, is made of stag's horn, Plate XLII. fig. 2; it is well polished, is 13¾ inches long, and it has towards the end a perforation wider than would be required to receive a hafting with a stone celt. Specimens of this kind have up to the present time been considered (although in my opinion incorrectly) as the insignia of the chief, like the *bâtons de commandement*.[1] About forty axe-hammers, perforated with a round or square hole, have been found, some with the piece of wood which was used for a handle. Some of these implements are peculiarly interesting, as the central part of the stag's horn, which is more or less soft, has been cut out and the space filled in with little cylinders of massive horn which have been inserted there to solidify the implement.

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[1] The densities here given of these specimens of nephrite and jadeite differ from those noted by Professor Fischer: they are, however, copied exactly from the paper of Dr. Von Gross.—[Tr].

[2] The small weight and the fragile nature of the birch-bark covering seem to be against this supposition.

I may further mention several ends of antlers artistically chiselled and polished, which have been perforated so as to be used as amulets, Plate XLIII. figs. 2, 3, 4; two little combs with three teeth, Plate XLII. fig. 15 and Plate XLIII. fig. 11, and a number of needles or bodkins of an oblong form, perforated at one end which were used for the manufacture of nets; one of them is pitted on one side with a number of small circular hollows placed symmetrically, Plate XLIII. fig. 5.

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[1] In a letter lately received from Mr. E. B. Tylor he very strongly urges the idea that these so-called 'bâtons' are neither more nor less than arrow-straighteners, such as are used by some races at the present day.—[Tr.]

The implements of bone are very numerous, but they do not exhibit much variety of form. They were chiefly made out of the fragments of long bones, which had been broken to obtain the marrow, or sawn longitudinally with a flint saw. These pieces were made into needles, awls (Plate XLII. fig. 8), arrow-heads, chisels, &c. The ribs of the stag or ox, sharpened to a point, were employed for several purposes; but most frequently they were split lengthwise, tied three together with string, and then used as a kind of comb for heckling flax. I have secured about twenty specimens, quite perfect, with the string which binds the three ribs together.

IV. OBJECTS OF VARIOUS KINDS.

Several wooden porringers of different forms and sizes, some fragments of string, of woven cloth, and of nets, similar to those found at Robenhausen by Mr. Messikomer. One very singular specimen, to which I believe nothing similar has yet been found in the lake dwellings, is a little rod of wood nearly 6 inches in length, with carbonised thread wound round it, Plate LXXXVII. fig. 6. If we imagine this wooden rod fixed into one of the little stone whorls already described we shall have the complete instrument (the spindle) which was employed in the stone age to make thread. Plate LXXXIII. figs. 4 and 6, represents an implement of yew wood like a spade or shovel in form. The handle is not fixed in, but was a side branch of the trunk, out of which was formed the body of the implement. It is now in the museum at Bern. Can it have been a tool used by the potter for smoothing the outside of large vessels?

The animal and vegetable remains have been especially studied by Messrs. Studer and Uhlmann (see the close of this report). With respect to the human remains, at about three feet below the surface there were found three skulls; two of them were tolerably perfect, and some bones of the trunk and the extremities were found near them.

The skull, which was in the best state of preservation, has been examined by Professor Vogt. The following are his remarks upon it, extracted from a letter from this learned Genevese professor to M. Gibollet, the owner of the skull in question.

'I was struck by the resemblance between it and the skull of a child found in the lake dwellings of Auvernier, and now in the collection of M. Desor, and of which I made as careful a study as my time allowed me. In both there is the same vertical curve and transverse narrowness of the forehead, the same deep insertion of the nasal bones, the same enlargement of the parietal regions, and the same roundness of the outlines. An attentive examination and a comparison with the materials at my disposal have confirmed these ideas. The skull itself is somewhat imperfect, unfortunately (as is usually the case) the bones of the face and those of the base of the skull are wanting, so that it is impossible to say anything as to the position of the great occipital foramen, or to take any important measurements based upon this opening. On the other hand, the upper part of the skull is in good preservation, at least on the right side down to the orbits, the foramen auditorium, and the mastoid apophysis.

'It is the skull of a young individual, as may be proved by the incomplete union of the cranial sutures (of which that of the occiput—the lambdoid, has several intercalary pieces) and the small remains of the upper jaw, as well as what is preserved of the lower jaw. The wisdom tooth has not yet appeared, the last grinder is but little worn, so that we may say that the skull belonged to a youth from about fifteen to seventeen years of age. At that age the sex can hardly be positively determined, but still I incline to think that it belonged to a young male. The curve of the forehead as well as the upper part of the head, hardly give the flatness which in general characterises the female sex.'

With respect to the character of race or type there cannot be any doubt. It is a magnificent specimen of the Sion type, such as MM. His and Rütimeyer have given in their 'Crania Helvetica,' pp. 12, 34, &c. The outline of the profile and that of the circumference (*norma verticalis*) are almost identical with those of the skull of a child found at Altorf (His and Rütimeyer, p. 36, Tab. *a*, xix.), and they agree remarkably, with the exception of the actual dimensions, with the skull of Auvernier (His and Rütimeyer, p. 37, Tab. *a*, xxi.). The profile also is almost identical with that of the skull of Möringen-Steinberg (His and Rütimeyer, p. 48, Tab. B, vii.), which MM. His and Rütimeyer consider as a mixed form (*Sion-Dissentis*). They add, however, that the 'profile agrees pretty well with that of the Sion type.' It is useless to enter further into particulars, for it would be simply to repeat what has been already published.

But this skull, fairly well preserved, and positively known to come from the locality indicated, proves anew that the pile dwellings of the Stone age were inhabited by people having identically the same cranial type as those of the Bronze age, and that the mixture of races in Switzerland did not occur till a later period.

Some few objects of interest have been discovered at Lüscherz which are not mentioned in Dr. Von Gross's report, and in order to complete the account of the place as far as possible they have been drawn in the following plates:—

Plate XLII.	fig. 13.	Spatula of stag's horn.
Plate XLIV.	fig. 12.	Hafting of stag's horn.
Plate LVIII.	fig. 13.	Bronze spoon.
Plate LXXVII.	fig. 3.	Earthenware vessel of the stone age.
	fig. 8.	Ornamented vessel of the bronze age.

Extracts from the report of Mr. Ed. Jenner on the excavation of the settlement of Lüscherz, made to the Commission for Regulating the Waters of the Jura.[1]

The works at Lüscherz were undertaken on Sept. 3, 1873. Nine men were employed, and a trench 5 feet broad was cut through the whole settlement. This first operation showed that the relic bed on the side of the land was only 2½ feet deep, but that on the other side it gradually deepened until it was nearly 7½ feet deep farthest from the shore. As water came in on every side, it was necessary to make cross trenches so as to keep back the water, which was then pumped out and sent back to the lake in small trenches. The outermost piles could not be reached, as the water from the lake came in too steadily, and the sides were continually falling in. Other trenches were made in the same manner, parallel with the first, leaving about 4 inches of earth between, and the rubbish was then thrown into the trench first finished. The relic bed was first examined in its original position, then its contents were thrown out and looked over a second time. This was absolutely necessary, in order that nothing of importance might be lost.

The lake dwelling in front of the village of Lüscherz lies parallel with the shore, which is there tolerably flat, and is connected with it by a short bridge. According to M. Combe's measurements, this settlement covers an area of about four acres; it apparently was not entirely constructed at one period, for the piles on the outer side, towards St. Peter's Island, not only in some measure differ in appearance, but are nowhere found in the same line with those of the original settlement, they are evidently an addition.

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[1] These extracts from Mr. Jenner's report, and also those which follow from M. Edmund de Fellenberg are not in the seventh report of Dr. Keller, but as it seemed desirable that English antiquaries should know the mode of examination and the difficulties attending it, they have been given above, though in a very condensed form.—[Tr.]

All the piles are not placed in double rows like those in most of the settlements in East Switzerland; only those of the south-east boundary have any approach to regularity.

Nothing has been discovered of the platform or scaffold of beams resting on the piles, but some pieces of round timber, from 20 to 25 feet long were lying horizontally, and were burnt on the upper side. In a few places layers of fir branches up to 5 inches in diameter were also lying horizontally. These branches have preserved their toughness to the present day. The piles are all of round wood from 5 to 8 inches in diameter, and consist of oak, beech, poplar, silver-fir, pine, and birch. All these different kinds of wood are used nearly in the same proportion, with a single exception on the north-west corner of the settlement, where, on what is called the 'Steinberg,' was an appendage, the piles of which consisted entirely of split oak stems from 8 to 12 inches in diameter, the method in which they were worked reminding one very decidedly of the piles of the bronze age settlements. Unfortunately no implement could be found in this place which would have decided whether this addition belonged to a later period or not; but the piles were very different, even in length, for they had not been driven into the ground more than 5 feet, while the others go down as much as 15 feet.

Now, if we consider that a large number of piles had first to be cut down and hewn with very primitive tools, then worked on the spot and driven in before the platform could be made and the huts built upon it, it may easily be imagined that an erection like this would have required years of labour, and can hardly be considered as a temporary place of refuge from other tribes, or as a protection against ravenous beasts; neither is it likely to have been used merely for feasts or banquets, as some antiquaries suppose from the large number of bones found there; whereas these very bones show that men must have lived here for years, while they accumulated and were thrown into the lake, thus bringing the fishes around them, which were of no small advantage to the settlers. These bones lying on the bottom were subsequently left dry, and formed part of the present relic bed.

As a further proof that these settlements were inhabited permanently and for a long period we may bring forward the following objects found here:—1st. A number of household hearths at regular distance one from the other, consisting of slabs of sandstone, with evident traces of fire upon them. 2nd. Heaps of grain, together with numerous crushing and mealing stones. 3rd. Cloth made from flax. 4th. Unfinished tools of every kind; and 5th. Weights for the looms.

The fear of wild beasts alone affords no sufficient grounds for a settlement on the water, for if the bones from any station which has been systematically worked be examined we shall find the remains of ravenous beasts very inconsiderable, both in number and variety, they could hardly therefore have been any annoyance to the men of that period or to the domestic animals. The only remains found at Lüscherz were those of the bear,[1] the lynx, the wolf, and the wild cat.

This station, like most others, was destroyed by fire, and this is shown most clearly from the fact that all the round timber which lay horizontally was burnt along the whole length, especially on the upper side. Many of the stone celts, pieces of stags' horn, bones, and cloth also show traces of fire. With respect to the cloth, these specimens are not to be confounded with those which are carbonised chemically in the same manner as the brown coal.

The fire began its ravages apparently in the north-west portion, and, urged on by the north wind, it must have spread rapidly over the whole settlement, for the inhabitants could only save themselves in their hasty flight by the connecting bridge, and were obliged to leave all their property to its fate, otherwise they would certainly have saved the valuable celts of nephrite, the stores of corn, and the cloth which had cost them so much labour to weave. Probably also some human beings were overtaken by the fire, not having been able to reach the bridge, and so fled to the extreme south-east corner, which was the last place attacked by the fire, and when that platform went down into the water, they fell with it, and were overwhelmed with the rubbish. Skulls and other human remains from this very place are in the collections of Drs. Gross and Gibollet, in Neuenstadt. The latter gentleman is in the possession of a nearly perfect skeleton.

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[1] In Dr. Studer's list of the wild animals at Lüscherz, given in the seventh report, there is no mention of the bear, but in the small volume from which the present account is taken, the same report by the same author is printed nearly word for word, and the first of the carnivora mentioned is the bear, so that there is a slight discrepancy.—[Tr.]

The results of my excavations, which occupied 27 days, and extended over an area of 20,000 square Swiss feet, at a medium depth of 3½ feet, the relic bed being from 2 inches to 1½ feet thick, were as follows:—

1. Stone implements	600
2. Stag's horn implements	490
3. Bone implements	235
4. Pieces of cloth	50
5. Objects for ornament	45
6. Entire vessels of pottery	11
7. Stone celts and axes in their haftings	23
8. Flint implements	121
9. Unworked pieces of stag's horn	430
10. Wooden implements	24
11. Ornamented potsherds	26
12. Clay weights	8
13. Celts of nephrite and jadeite	8
14. Corn, seeds, fruit, &c.	
15. Pieces of bone, of jaws, of stag's horn, &c., a great number.	
16. Sundries, 16 specimens	
17. A number of net weights in birch bark.	

The above are the chief points of interest (not mentioned in the seventh report of the Zurich Society) in Mr. E. Jenner's account. It appears that Mr. Jenner acted as deputy to Mr. Edmund de Fellenberg, who superintended the works on behalf of the Swiss Government, but who had been called away by military service. He has added an appendix on Lüscherz, from which the following notes are extracted:—

Appendix on the Lake Dwelling of Lüscherz, by M. Edmund de Fellenberg.

As a supplement to the account of Mr. E. Jenner, I venture to remark with respect to the mode in which the settlement was burnt, that, probably from the later examination of the locality by Mr. Combe, the lake dwelling was connected with the mainland not merely by one but by several bridges, and also that a large portion of the settlement approached the bank, so that the settlers had more than one outlet to resort to in their flight. I must, therefore, consider the view taken by

Mr. Jenner of the direction followed by the conflagration to be somewhat problematical. Still it is very certain that the greater proportion of our lake dwellings were destroyed by fire, as may be proved by the burnt condition of most of the wood; and we must also bear in mind that there may have been repeated devastations by fire, probably from the constant warlike attacks and raids of hostile races; as, for instance, at Lüscherz, where Mr. Jenner in some places has found *two* relic beds. There appears to be no doubt that the number of objects of daily household use, such as weapons and victuals, which were left there, most probably indicate a hasty abandonment of the settlement.

It is very singular that this great lake dwelling in front of the village of Lüscherz remained quite unknown until very lately. At least I could find no specimens labelled Lüscherz in the splendid collection of lake-dwelling objects from the Lake of Bienne in the Schwab Museum at that town. In like manner the important settlement of the stone age at Gerlafingen (Œfeliplätze), and the small station near Hagneck, do not seem to have been known at the time when the late Colonel Schwab was collecting; or possibly the piles were known but no implements had been found.

With respect to the nephrite and jadeite celts, so interesting in the history of civilisation, I would merely remark, from the observation of my father, who has examined and had in his hand the greater part of the specimens of both these minerals found in Switzerland, that the nephrite is most commonly found in the lakes of East Switzerland, while the jadeite prevails in the west. We may ask, have the immigrations taken place from different sides; or had these races barter transactions in different directions? My father's remarks are fully confirmed at Lüscherz, for here jadeite occurs far more commonly than nephrite.

The general appearance of these two minerals is as follows:—The jadeite is for the most part decidedly translucent, and varies in colour from the purest sea-green to apple-green, and from that to greyish-green and milk-white, which last variety is the rarest. It is commonly spotted and streaked with dark green portions. The nephrite is in general dark sea-green and olive-green, less translucent, and it passes very frequently into dirty greyish-green and grey. While the jadeite, when well-polished, has a dull vitreous lustre, the nephrite has always a kind of greasy appearance, besides which it is for the most part either partially or wholly slaty. Many specimens were found at Lüscherz, which exhibit decidedly slaty layers. Certain portions of this nephrite are cinereous and clear, with a peculiar silk-like lustre. A splendid celt of jadeite, more than 3½ inches long, the largest hitherto found in Switzerland, was found at Lüscherz, and was given by Dr. Von Gross, of Neuenstadt, to the antiquarian collection at Bern; its colour is clear apple-green, with the exception of two flat surfaces, where one may see the compact fracture of the mineral; it is beautifully polished and extraordinarily sharp.

Of the whole number of stone implements found at Lücherz, consisting of many hundreds, probably not more than two dozen were of nephrite or jadeite.

The smaller celts of these valuable minerals were found still fixed in their stag's horn haftings.

On the Animal Remains from the Lake Dwellings of Lüscherz and Möringen, by Dr. Theophilus Studer of Bern.[1]

The excavations in the lake dwellings of Lüscherz and Möringen, on the Lake of Bienne, which were carried on in 1873 and 1874 by the Government of Bern, have brought to light, together with most important archæological treasures, a rich store of animal remains which have been handed over to me for examination and determination. Even if these remains offer nothing essentially new, nor throw any fresh light upon the fauna of the lake dwellings, yet they are of very great interest with reference to the history of civilisation, more especially as to the development and breeding of cattle. The two stations mentioned above lie far apart in the history of civilisation. Lüscherz, from the implements found there, belongs exclusively to the stone age, while Möringen has yielded only implements of bronze. On this account it was of especial interest to collect all the bones very carefully, in order, if possible, to obtain a statistical view of the relative proportions to each other of beasts of the chase and of domestic animals, and also of the particular races of the latter. And a rich store of materials has been brought together for this purpose by the care of M. E. de Fellenberg and Mr. E. Jenner, who conducted the excavations.

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[1] This paper is given precisely as it stands in Dr. Keller's seventh report. I had imagined from the title and from an expression used by Dr. Studer, that there would have been two lists of animals, but Dr. Keller informs me that the fauna is the same in both cases, and the list given applies to both stations.—[Tr.]

At the present time I will occupy myself with the animals of Lüscherz, and in the first place will consider those which are wild. On the whole the bones are well preserved; certainly the skulls are for the most part much broken. The dog is the only animal of which we have a perfect skull; but, on the other hand, the perfect rami of lower jaws, with complete rows of teeth, are very abundant. Also the metacarpal and metatarsal bones of ruminants and the long bones of the carnivora are almost always perfect, but the long bones of cattle are universally broken in two, chiefly across.[1] The horns also are nearly all sawn in pieces. The colour of the bones is dark brown. According to the analysis of Dr. C. Aeby this arose from a substitution of oxide of iron for carbonate of lime. The bones of the wild animals are of a clearer brown, and the surface is more polished; their solid nature may possibly have presented a greater obstacle to the change:—

I. WILD ANIMALS.

Mammalia.

Meles taxus, L. (The badger.)—The humerus of a young animal.

Canis lupus, L. (The wolf.)—A radius and a tibia of a very large animal.

Canis vulpes, L. (The fox.)—The bones of the extremities of several individuals. On the average they are smaller and more slender than those of our modern fox.

Felis catus, L. (The wild cat.)—The bones of the extremities of three individuals, generally agreeing with those of our common wild cat.

Felis lynx, L. (The lynx.)—A humerus of a young animal; the upper epiphysis is still separate, but the size of the bone leaves no doubt as to its correct determination.

Erinaceus Europæus. (The hedgehog.)—Of this animal the front portion of the skull was found perfect, with all the teeth; also a few of the long bones, which probably belonged to the same individual.

Castor fiber. (The beaver.)—The remains of five individuals, consisting of the perfect half of the lower jaw, the front portion of a skull with the teeth, the occiput, and some bones, amongst which the tibia is the most common. The bones are chiefly those of young individuals, as the premolar was just protruding, and the epiphyses had not united. The femur of an old animal does not exceed the maximum measurement given by Cuvier to the beaver.

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[1] Evidently to extract the marrow, as appears to be the universal practice among prehistoric and aboriginal races.—[Tr.]

Lepus timidus, L. (The hare.)—This animal is found but rarely in any lake dwelling, and has left only scanty traces at Lüscherz. The remains consist of four bones of the upper part of the thigh and one tibia.

Sus scrofa ferus, L. (The wild boar.)—Of this animal some large fragments of the skulls of old animals were found, and also a few great tusks, but the other remains are not numerous. Respecting some detached rami of the lower jaw I cannot venture to decide whether they belonged to females of the wild or the domesticated pig.

Cervus alces. (The elk.)—Of this large species of stag, which at the present day is only found in some districts of East Prussia and in the middle of Sweden, fragments of an antler of ten tines were found. These were scattered about in different places, but they fitted together perfectly. They were joined together, and made into a splendid antler by the skilful hand of Mr. E. Jenner.

Cervus elaphus. (The red deer).—The remains of this animal are found in abundance, but chiefly the horns, which for the most part are worked. Of the other remains comparatively few have been met with, such as fragments of the skull, nine lower jaws, and some long bones and vertebræ.

Cervus capreolus. (The roe).—This is the only kind of stag now met with in Switzerland. The remains found at Lüscherz were a well-preserved lower jaw and a metacarpus.

II. BIRDS.

This class has left but few remains. As yet I have only been able to recognise the wing-bones of a swan, the femur of a duck, probably of *Anas crecca*, and some other bones which I cannot at present determine exactly.

III. AMPHIBIA.

Rana esculenta. The green frog.

IV. FISHES.

The numerous scales found in the mud have yet to be determined. The only bones found were fragments of the lower jaw of a colossal pike.

This closes the list of wild animals. As was to be expected, they are the same as those whose remains are found in all the lake dwellings, and which, with the exception of the beaver and the elk, still inhabit our district; when compared with other lake dwellings only the bear and the *Urus Bos primigenius* are wanting; the bones of the latter could hardly have escaped notice. Perhaps this colossal ruminant had even then withdrawn from the inhabited districts.

V. DOMESTIC ANIMALS.

Canis familiaris. (The dog.)—Of this faithful attendant on man the remains found were extraordinarily numerous and perfect, more especially a number of skulls in good preservation. These have the same form both of the skull and the teeth as that described by Rütimeyer in the fauna of the lake dwellings, only the occipital ridge appears to be less developed and the brain-case more rounded. The measurements approach nearer to those given by Rütimeyer as the maximum measurements, as shown in the following table. The first column R, gives the maximum of Rütimeyer; the second L, the average measurement of the dog at Lüscherz:—

	R.	L.
Length of the skull from the front edge of the foramen magnum to the alveoli of the incisors	150	140
Length from the foramen magnum to the hinder edge of the bony palate	64	61
Length of the bony palate	85	80
Length of the nasal bones on the median line . . .	58	50
Greatest breadth of the upper jaw at the edge of the alveoli	59	—
Greatest breadth of the forehead between the orbital processes	47	—
Length of the under jaw from the angle to the edge of the incisors	120	120
Humerus, full length	144	150
Radius	128	135
Femur	144	150
Tibia	144	148

Together with this very prevalent species another race appears to have existed which had the same dimension of the brain-case, but the forepart of the skull was shorter and broader. The bony palate is broader, as is also the intermaxillary, but the nasal bone is shorter.

The remains of the dog were as follows:—7 perfect skulls, 12 frontal portions of the skull, 6 brain-cases, and 28 lower jaws, together with numerous long bones.

Sus scrofa palustris, Rütimeyer.—The marsh pig has left behind it numerous remains, more especially its jawbones, the teeth of which indicate animals of all ages. All of these show very decided evidences of domestication by the narrow strip of enamel, the increased size of the intermediate projections of the molars, and the roughness and freedom from polish of the bones. Some specimens seem to indicate a cross with the wild boar,[1] more especially a frontal portion of a skull with all the teeth perfect: the molars and præmolars have quite the characters of the marsh pig, while the toothless part is of the same length, as in the domestic pig. Some few lower jaws seem to indicate the domesticated boar. In all more than 50 fragments of bones (of the pig) were found.

The Sheep.—Many lower jaws, fragments of the skull, and long bones of this animal were found. Most of the remains indicate the characters of the horned sheep. One half of a skull alone, which appeared to have rested on the upper surface of the relic bed, but which, both in colour and appearance, agreed exactly with the other bones, showed the flat horn-core more bent outwards and downwards.

The goat appears in about the same proportions as the sheep.

Oxen.—The remains of these animals were by far the most numerous; they were of all ages. Not less than 160 pieces of the skull and jawbones were found. There were also an immense number of vertebræ, ribs and bones of the extremities, amongst which especially the metatarsal and metacarpal bones were quite perfect. On the whole, these bones, more especially the well-preserved lower-jaws, seem to indicate three races.

1. *The Brachyceros race.*—After a careful measurement and comparison with the typical specimens in Dr. Uhlmann's collection at Münchenbuchsee, there are only two horn-cores, two lower jaws, the fragments of a skull, and a few humeri and radii, which lead us to consider that they belong to the pure 'Peat cow.' To this race may also probably belong the half of an occiput of a hornless individual. The specimen indicates a very small animal in which the occipital projections were decidedly high. Similar forms are said to be found amongst the Norwegian cattle.

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[1] When common pigs run wild, as in the case of those landed in New Zealand by Captain Cook, 1769, the boar acquires enormous tusks, although the animal is small in size. The tusks of one lately shot on a sheep run, 60 miles from Dunedin, measure 10 inches in length along the curve. They are preserved in the British Museum.—[Tr.]

2. *The Primigenius race.*—This great race of oxen appears to have been found but sparingly at Lüscherz. The only remains found are a few horn-cores, and the half of an occiput with horn-cores of the *Trochoceras* form. Also the head of a femur. Two under jaws appear to indicate a cross between this race and the following one.

3. *The Frontosus race.*—By far the most numerous remains belonged to an ox, which although on the average smaller than our spotted cow, yet possesses its characters most completely, more especially the rows of teeth in the under jaws are the same in length, and both in the chest and the rounded form they agree entirely with *Bos frontosus*. The skulls, more especially the halves of the occiput and the frontal bones with the horn-cores broken off, exhibit a certain arching of the orbits, and comparatively a short horn like the actual *Frontosus*. The bones of the extremities are smaller and more slender than those of the spotted cow are in general. The masticating surfaces of the teeth are not worn flat, but have a sawlike appearance which indicates harder food, and such as required rather to be chewed than ground up, a fact which sufficiently explains the short duration of the race. The following are a few measurements:—

Table of measurement of skulls of *Bos frontosus*.	Simmerthal	Lammerthal	Lüscherz or average numbers
From the knob of the ear to the front of horn-cores	72	70	70
From the base of the horn to the orbit	180	175	170
Half the breadth of the forehead between the horn-cores	115	120	90
Half the breadth of the forehead between the temples	100	100	97
Height of the foramen magnum above the hinder edge	140	110	100
Occiput between the horn-cores	85	100	78
Length of the row of teeth	150	130	140
Length of the lower jaw from the angle to the alveoli of the incisors	400	385	360
Length of the symphisis of the lower jaw	70	70	68
Molars 1–3	100	95	95·120
Præmolars 1–3	60	60	50·60
Præmolars 1—Alveolus of the incisors	135	120	95·140

If we put these facts together, the first thing to be noticed is that the wild animals of the chase give place to the domestic animals. Of the latter, the oxen are the most numerous, more especially the *Frontosus* variety, which belongs more especially to civilisation, and which presupposes a long period of attention to breeding. The original races of cattle on the contrary have greatly diminished. The marsh swine is only found in a domesticated state, and the wild boar appears already to have been tamed. The appearance of the dog in such abundance is moreover very striking. We have here, therefore, a considerably higher grade of civilisation in breeding cattle than is exhibited at Moosseedorf, Wauwyl, Robenhausen, Wangen, and Meilen, and these facts also prove to us that in the stone age we have to do with an extraordinarily long epoch in the history of civilisation.

THE LAKE DWELLING OF SCHAFFIS (CHAVANNES), IN THE LAKE OF BIENNE.

Chiefly taken from the notice given by M. E. DE FELLENBERG.[1]

THE lake dwelling of Schaffis or Chavannes is on the left or northern bank of the Lake of Bienne, about a hundred paces beyond what is called the 'Great House.' Some years since traces of a pile settlement were observed at a time when the sloping strand was covered with water, but it was then so completely overgrown with vegetation that the station could hardly be distinguished. A small canoe in good preservation was discovered here, and was taken to the museum at Neuenburg. Since the year 1870, as the level of the water was continually sinking, the lake dwelling became more and more visible, and a search for antiquities was made on the surface, but only a few specimens were found; and some flint implements, some very coarse pottery, and a few decayed fragments of stag's horn were the only indications of the existence of a settlement. The iron scraper of the mud machine could not enter the lake bottom on account of the matted weeds and rushes, so that but little was done at that time, and Schaffis was considered a very poor and unpromising lake dwelling.

In the autumn of 1873, however, the greater part of the settlement appeared above water, and I was convinced that it must have been of some extent, although most of the piles had rotted down level with the ground, and were very difficult to find. Three very decided 'steinbergs' were at once remarked; two of them adjoining one another and forming an elliptical rise gently sloping away in all directions; a smaller but very characteristic steinberg lies about 45 feet north-east of those just mentioned, and which being further in the water had been made a little higher. These steinbergs are good types of this peculiar kind of structure. As the shore of the lake consists of fine mud or sand, and gravel is only found in patches, the steinbergs are formed of blocks of every possible kind of rock, evidently brought there for the purpose. Many of the stones have been broken, and several show the traces of fire. Loose sand has been washed in between the stones by the waters of the lake. The only piles which project are those of oak, and these are only about half a foot or a foot above the ground, the piles which were of softer wood have been worn down by the action of the water, and are difficult to find, even on the steinberg. Round about the steinberg, the piles are placed in irregular rows, stretching out into the lake from 30 to 36 feet; the whole length from east to west being about 590 English feet. Several bridges or small platforms communicated with the shore. Eight are said to have been ascertained. The landward face of the platform was bounded by a close palisade of piles; this palisade extends from one bridge to another, and appears to have been the boundary of the general platform towards the shore. A long platform, not very broad, stretched from the great steinberg in a westerly direction, and possibly may have reached the land, but this cannot be determined, as the exact position of the ancient shore cannot now be ascertained, for the vine terraces, which form the present shore, have certainly been built on ground which has been recovered from the lake.

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[1] The short account of this lake dwelling given by Dr. Keller in his seventh report is chiefly, but not entirely, condensed from the report made by M. E. de Fellenberg to the Commission for regulating the waters of the Jura, and the reader is referred by Dr. Keller to M. de Fellenberg's paper for further information. The above account is slightly abridged from this paper, and with it are incorporated some particulars given in the seventh report.—[TR.]

The first excavations, both on the small and on the great steinbergs, gave such good results that I determined to investigate the whole settlement thoroughly. The upper surface of the steinberg consisted of loose sand and stones which had been washed there. This had in the first place to be removed, and we had hardly taken away from four to six inches of this sand bed before we came down upon the relic bed. This bed was thickest on the southern side of the steinbergs, where it was nearly 23 inches thick. On the 'great steinberg' the thickness varied from 18 inches English to 2½ inches. It was thinnest on the northern side, but even there it was 11 or 12 inches thick. We had most certainly never been so fortunate before; therefore, instead of setting a large number of men to work, I preferred to commence the excavations with one or two very careful trusty people, so that we might be able to examine the relic bed thoroughly and completely. The very thickly matted roots of the rushes, which in part covered the steinbergs, had completely destroyed the organic remains on the surface, and so far as this extended nothing perfect was to be obtained, with the exception of the stone and flint implements. Stag's horn haftings and bones, worked and unworked, were so decomposed that at the slightest touch they crumbled to pieces. This will explain why so little had been got at Schaffis by surface scraping. The relic bed is essentially different from that of the settlements we had previously excavated. At Möringen the relic bed when fresh was of a dirty brown colour, and the twigs, wattle-work, and the ancient vegetable matters were preserved in layers unchanged. And again, at Lüscherz, where the colour of the relic bed is a dark brown, verging on black, the organic remains such as bones and vegetables were of a very characteristic chocolate-brown colour. On the other hand the relic bed at Schaffis is already half changed into peat, and the tender vegetable productions are preserved in their original form, but like the bones are perfectly black. It was only in the lowest part of the relic bed that in certain portions this chemical change had not advanced so far; and in these cases the colour was brownish yellow, and the organic remains were in a good state of preservation.

I began by having a cross trench dug on the great steinberg on the western side towards the middle, and this showed the regularity and thickness of the relic bed. It ceased entirely when it approached the ancient lake bottom (blanc fond). This consists of a fine white and extremely soft mud, into which a pole ten feet long can be thrust with the greatest ease. The labourers consequently, when the relic bed had been removed, were obliged to stand on boards so as not to sink into it. This old lake-bottom contains the remains of numerous shells, like the shell-marl under the peat moors.

The piles of the settlement of Schaffis are different in many respects from those of other stations. They are generally placed close together, seldom more than two feet apart, but quite irregularly. Most of them are of round timber, from three to seven inches in diameter, the bark still remaining on them. They have been driven three or four feet into the shell-marl, which must have been an easy matter in such soft ground. The sharpened portion is short and very roughly done, not running gradually to a conical point like the piles of the bronze stations. Many of the piles at Schaffis have been split from thick stems, divided either into three or two; the latter are very frequently of oak timber. No long cross-beams have hitherto been brought to light; the only larger piece of timber found between the piles was a stem about half a foot in diameter, but twigs and basket-work were very common. Charred pieces of wood and boards are not rare, and they prove that probably this station also was destroyed by fire.

The implements are of great interest, as they exhibit a peculiar type of the stone age. A few of them must now be mentioned and compared with those of other stone age stations.

In the first place, we are struck by the large number of stone celts and hatchets found here being much smaller than those found at Lüscherz and other stations. Out of hundreds, which we got from the relic bed, only a few are from five to six inches long; most of them are only three inches in length, and numbers are found still smaller. Some are only four or five lines long and proportionably broad. It is also a striking fact that we never see the marks of saw-cuts on the celts, and that, though in some cases they are well ground or polished, yet in general workmanship they are far below those found at Lüscherz. I had supposed that the art of cutting the stones was unknown to the ancient inhabitants of Schaffis till we found a stone cut in a very primitive manner, but still it was not to be compared with the beautifully cut celts from Lüscherz. Together with these very poor and primitive stone implements there were found two larger unfinished stone celts, and a hammer; these were interesting, as circular holes had been bored three lines deep from both sides, and yet the workman had not succeeded in bringing his work to perfection. While in the stations of the later stone age the holes bored (for the reception of the handle) are mostly circular and smooth at the sides, as, for instance, the beautiful perforated celts and hammers of Greug, Sutz, and, to a certain extent, of Lüscherz also, these unfinished perforations at Schaffis appear to have been conically widened; they are rough at the sides, and do not seem to have been made in what is commonly supposed to have been the usual manner, viz., by the revolution of a hollow bone filled with quartz, sand, and water, but to have been, as it were, gouged out by hand with flints.

Of the foreign kinds of stone only two small celts of jadeite have been found. The colour is milk-white or greenish grey. They are half and three-quarters of an inch long and from four to six lines broad at the edge. Also one other celt of very beautiful dark green nephrite, one inch in length, of undoubted purity, and with a perfectly sharp cutting edge.

This settlement has been long known and mentioned as one in which both nephrite and jadeite were found, although probably very rare and highly valued. Schaffis is also remarkable for the numerous grinding stones of sandstone and quartzite, on which the celts were sharpened. A number of them have been found, showing clearly the deep furrows worn in them by the process. These grinding stones are of every possible size; there are slabs a few inches in length, with two or three furrows, and there are others varying in length up to two feet and a half, which are covered with long furrows. The mealing-stones may be easily distinguished from them, as they are chiefly made of harder stone, and have one smooth surface somewhat pitted. The corn-crushers used with these mealing-stones are small and very primitive. Amongst all the known settlements in Switzerland Schaffis is remarkable for the number of its beautiful flint implements.

We may in the first place mention a splendid flint lance-head, which is ten English inches in length, and decidedly narrow, made of dark brown flint rather verging towards violet colour. The under side of this capital specimen has a regular smooth surface made by percussion; on the upper side there are three similar planes; both the side edges are finely serrated, so that this implement might be called a saw as well as a lance-head. It is sharpened quite gradually, and runs uniformly to a point on both sides. Flint flakes or knives, five or six inches in length, are found in abundance, and every variety of colour is met with —grey, yellow, dark brown, and white. Several scrapers were found, still in their haftings of wood, with a small handle, and also some set in ribs of the stag and the ox. These can only be preserved in spirits of wine, as they soon fall to pieces on exposure to the air. Another lance-head was formed of an impure slaty flint, about eight English inches long, and nearly an inch and a half broad, but unfortunately it was broken in two in the middle. Several lance-heads yet retain traces of the wood, and also of the cord and strips of bark which fastened them to the shaft. The flint arrow-heads were numerous and very beautiful. Many are barbed, and the work is well and carefully executed. Some of these arrow-heads were fastened into the wooden shaft by a thin flat peduncle forced into the wood, and then secured by being bound round. Other specimens were found parti-coloured, more especially one arrow-head made of jasper, of a yellow colour, with brick-red spots, very similar to those found in the north.

Many peculiar implements of horn and bone were found at Schaffis. Hammers were common, made of stag's horn, one end sharpened like a mattock, and the other rounded off on the beating face; the handles were of wood. One of these hammers was perforated with circular holes, through which wooden pegs were driven to fasten the handle to the hammer. One description of hammer seems new; it was made of a portion of a stag's antler, with several tines of the antler still projecting in the form of a fork. The points had been cut off, and the middle of the part near the crown had been perforated with a circular hole to admit the handle. Thus the four or five diverging stumps of the points cut off formed the same number of separate hammer faces, and gave it the appearance of a 'morgenstern.' Where the inside of the stag's horn was porous and soft, wedges of fresh horn were inserted so as to strengthen the whole.

The following implements seem new and peculiar to Schaffis: Double haftings for stone celts and chisels. Many of these were found about a hand's breadth long, in both ends of which small chisels were fixed. These were evidently held by the hand and used as occasion required. Other haftings are also hollowed out at both ends. At one end a wooden handle was fixed, made of an angular or bent branch of a tree, and the stone implement was fixed in the hollow at the other end. We were fortunate enough to obtain from the relic bed several of these combined handles, both with hafting and stone. The usual haftings were found by hundreds, and were for the most part beaked like those of Concise, that is, the part of the hafting containing the stone celt projects considerably beyond the squared portion fitting into the handle. Chisels made of stag's horn were plentiful.

Harpoons, with barbs made of stag's horn, were also found here as at Moosseedorf. They are perforated at the lower end. One implement was also found here which has been obtained from other settlements, but of which the use is unknown. It consists of a cylindrical pointer, or awl, or small staff bent in the shape of a bow, and having in the middle of the curve a perforated appendage. Implements like spatulæ and slabs of horn perforated above and below are also not uncommon.

Schaffis is also very rich in implements of bone, which are decidedly different from those of Lüscherz. Triangular daggers ground to a sharp point, made out of the ulna of the stag, are common at Lüscherz, but up to the present date none have been found at Schaffis. On the other hand, pins and awls, or pointers, are found in large quantities, and what we have hitherto considered as double pointers made out of stag's horn or bone are now known, or at any rate a portion of them, to be arrow-heads, for some have been found fastened with string into wooden shafts.

Flaxheckles or combs occurred like those at Lüscherz, but they were made of the ribs of smaller animals, well sharpened both above and below. They consist of six, or even more, ribs fastened together with a flaxen cord. Amulets of horn and bone, very roughly executed, with incisions and perforations, have also been found as at Luscherz, but only in single specimens. The canine teeth of the bear, perforated for suspension and carved for ornaments, are found abundantly. No station has yielded so many bear's teeth as Schaffis.

Boar's tusks of extraordinary dimensions have been found here, and show that this wild animal was of very great size.[1] Several of them had been sharpened and made into chisels, and the same thing had been done with the few incisor teeth of the beaver which were met with here.

Amongst the wooden implements, besides the numerous well-preserved celt-handles before referred to, a number of wooden clubs were found like those at Lüscherz, in which the celt was set direct, without any intermediate piece of stag's horn. Rough flat cobble stones fixed in similar clubs may have been used as hammers for driving in the piles.

One of the most singular specimens made of wood which has been found here is the door or shutter drawn on Plate CL. fig. 5, *a–h.* It probably was the door of a cupboard or closet. It may, however, have been larger originally, as it appears as if burnt in several places. The board itself is of firwood, and it has been carved so as to allow of a very substantial oval bolt, rather flattened on one side, made of yew, to pass through it. Both ends of the bolt also appear burnt. It will be seen from the sketch that the wood has been left thicker at the two sides to allow of the perforation for the horizontal bolt. The opposite side of this shutter is quite flat.

We come lastly to the earthenware vessels, which are the roughest of their kind of any yet found in the Swiss lake dwellings. The clay is hardly burnt at all, and it is mixed throughout with pieces of quartz and little round stones the size of a pea. The vessels are for the most part cylindrical, hardly rounded; several are angular or many-sided, and have been made by the hand alone. The base is often three-quarters of an inch thick, and the sides seldom less than three or four lines, and without any trace of ornamentation. The thicker portions or knobs so characteristic of the earthenware vessels of Lüscherz are here entirely wanting. The clay of these very rough and primitive vessels has been so little burnt that it falls to pieces at the slightest touch, and we only once succeeded in getting out a perfect specimen. Some clay balls of half-burnt loam, perforated in the middle, are interesting; they are nearly six or seven English inches in diameter, and four or four and a half inches high, and have been imperfectly burnt, but became moderately solid after exposure to the air. It cannot be decided whether they were the supporting rings for vessels having a pointed base, or were merely used as weights.

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[1] See note as to boar's teeth on p. 209.—[Tr.]

Lastly, not a single specimen was found at Schaffis of the net-sinkers made of stone, and bound round with birch bark, which have only been found at Lüscherz, and appear to be typical of that station. Platted and woven flax have been found, but not so well preserved as at Lüscherz. A twisted tassel of flax, of the thickness of the finger, is very peculiar.

It cannot yet be determined whether the relic bed under the huts differs from that beneath the general platform, as the excavation has not yet gone far enough, and hitherto we have only worked on a steinberg. Some layers of a reddish, tough, and very firm loam were conspicuous in certain parts, running in a straight line through the relic bed; in some places these layers were more than a foot thick, but they contained few implements. This loam is so different from the grey fine loam of the lake-bottom that it must have been brought from a distance. This yellowish red loam was probably fetched from the slopes of the mountain (called 'Valengien') by the inhabitants, and laid on the floor of their huts to make them water-tight.

To conclude—if we compare the implements found at Schaffis with those from Lüscherz and other stations of the stone age on the lake of Bienne, such as Lattringen and Sutz, we shall be convinced that Schaffis belongs to an earlier period, when the working of polished stone implements was yet in its infancy, while the splendid flint implements again indicate the point of culmination of this earlier period—the palæolithic. The roughness of the pottery, which cannot be distinguished from that of the earlier or cave period, and which belongs to the very commencement of this branch of civilisation, agrees well with the characters of the implements made of stone and flint, and also of horn and bone.

Very few human remains have as yet been found at Schaffis; but our attention will naturally be arrested by the discovery of a human calvaria found in the relic bed nearly in the middle of the steinberg. It certainly is most interesting, and the account of it given by Professor Ch. Aeby is appended at the close of this paper.

The following dimensions of the settlement of Schaffis were taken in July 1874 by M. Lindemann:—

	English feet
Length of the whole lake dwelling from west to east	640
Greatest breadth from the second bridge across the steinberg	167
Length of the great steinberg from west to east	217
Average breadth of the great steinberg from north-east to south-west	65
Length of the small steinberg from east to west	98
Breadth of the small steinberg from north to south	59
Length of the western platform	197
Average breadth of ditto	74
Length of the eastern platform from the small steinberg to the east	89
Breadth near the little steinberg	103
The breadth of the bridges varies from 4 feet to	10
The shortest bridge, measured from the edge of the platform to the shore	30
The longest, ditto ditto	62

NOTES ON A HUMAN CALVARIA FORMED INTO A DRINKING CUP FOUND AT SCHAFFIS.[1]

By Professor Charles Aeby.

Human remains were found very sparingly at Schaffis, as is the case in nearly all the lake dwellings. The most interesting of all the human bones found here was the upper part of a skull, or calvaria, which on close examination appears to have been that of an adult; it has been worked and artistically made into a cup by human hands.

I will not refer at the present moment to the peculiarities of race shown in this skull, as this is of subordinate importance to the character of the utensil prepared from it, but I will merely state that it agrees with those skulls formerly found in the lake dwellings, and respecting which I hope to speak at some future time. It undoubtedly belonged to an adult. The sutures on the inside are quite obliterated, but outside they are still visible. The outer surface is smooth and regularly arched; the marks showing the line of the muscles are well defined but of medium size. The occipital projections and the mastoid processes are weakly developed. The inner surface has along the median line the traces of 'Pacchionian' granulation, and on the side there is a strikingly rich network of deep arterial furrows. The frontal bone is three-tenths of an English inch in thickness, and the parietal bone somewhat less. The length of the skull taken from the frontal eminences to the occipital processes is 6¾ English inches, and the breadth where broadest is very nearly 5½ inches; between the outer surfaces of the mastoid processes it is very nearly 5 inches. I calculated the horizontal circumference at the level of the longest diameter to be 19¾ English inches, and the cross circumference between the auditory foramina over the crown to be as nearly as possible 12 inches. The longitudinal arc cannot be given exactly, as part of the frontal bone is wanting. The distance from the middle of the coronal suture to the hinder edge of the occipital foramen is nearly 9½ inches. From this fact I think it may be concluded that the skull belonged to a female. A similar skull of just the same dimensions in our collection here contains 1,234 cubic centimetres (=75·30 cubic inches), a capacity which is at once below my estimated average of 1,313 cubic cent. (=80·12 cubic inches) for women's skulls; the extremes being 1,192 cubic cent. (=72·74 cubic inches) to 1,464 cubic cent. (=89·34 cubic inches), and also below the minimum capacity of the male skull, which has an average of 1,483 cubic cent. (=90·5 cubic inches), the extremes being 1,293 cubic cent. (=78·9 cubic inches) to 1,724 cubic cent. (=105·207 cubic inches).[1]

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[1] This paper was originally published by the author in one of the numbers of the 'Journal of the German Anthropological Society.' It was afterwards reprinted by his permission in one of the Swiss journals. It is from this reprint that the above account is taken. Nothing has been omitted except some general remarks on the lake dwelling of Schaffis, which would have been almost a repetition of some parts of M. de Fellenberg's paper.—[Tr.]

Let us now turn our attention to the utensil which has been made out of this skull. It is quite perfect, except in one place where, during the process of excavation, it was cut by the spade superficially to the left of the parietal suture. Even the edges have not been damaged in the least. It comprises the upper part of the brain case, on the back part up to the squamous border of the occipital foramen, and in front as far as the region of the frontal eminences. The front portion of the border is nearly in a straight line, at right angles to the upper surface, and is broken off where the circumference of the skull was the largest. It begins at the very highest point of the temporal suture, and continues on through the frontal eminences, but not quite horizontally, evidently from the unskilfulness of the workman verging somewhat to the left. In consequence of this the end of it is about three-quarters of an inch too high, and the result is that the junction at the temporal suture is nearly in the form of a right angle. On the right side the marks of the chisel which was used in the operation are distinctly visible, as, instead of the edge running on continuously, there are step-like breaks in it from a tenth to nearly a fifth of an inch high. On the left side this appearance has vanished in a measure, the skull evidently having been gnawed by some carnivorous animal, which has left the marks of its teeth very distinctly. The hinder part of the skull has quite a different character. The edge or border is symmetrically arranged, but the workmanship is coarse. It does not accord with the direction of the front half, but it bends through the squamous portion of the temporal bone downwards to the projection of the root of the zygomatic arch, and then passes above the outer auditory foramen, through the upper end of the mastoid processes, round the squamous portion of the occiput, to the hinder portion of the occipital foramen. About 1⅓ inch of this part still remains. Evidently this piece of the occiput, which projects from the outer side of the skull, has been used as a handle, and in fact the cup, if the thumb be placed in the hollow of the occipital foramen, and the remaining portion of the hand laid on the arching surface of the occiput, can be held with perfect ease and safety. I will merely add that the greatest depth perpendicular to the edge of the front half is about 2¾ inches. When nearly filled to the brim it contains 45¾ cubic inches.

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[1] The average of the female skull from the data given 1,192 to 1,464, appears to be somewhat different from the result mentioned, at least if the mean of the two extremes be taken for an average. In the above translation, therefore, the exact cubic centimetres are given from the original, and the cubic inches calculated from them are given in parentheses.—[Tr.]

Without again referring to the chisel marks found upon it, the regularity of the whole thing leaves no doubt that we have before us not the result of blind chance but a well-considered piece of workmanship by human hands, equally adapted for dipping or for drinking. But what incited the maker to use such an unwonted material? Did mere caprice impel him? or was he driven to it by some weightier motive? No certain answer can be given to this query. Possibly future discoveries may throw light upon it. We may, however, mention that the custom of fashioning human skulls into drinking cups has been attributed to several nations.[1]

I will merely remark further that the cup in question has been placed in the extraordinarily rich collection of lake dwelling remains in the state library of Bern.[2]

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[1] Herodotus, iv., 65, mentions this custom amongst the Scythians.

[2] Since the above was written out for the printer, in passing through Oxford on my way to London, Professor Rolleston kindly showed to me three specimens of drinking cups made out of human calvariæ.

The first was Australian. It was, in fact, a simple skull with the facial bones knocked away, and by the notice which accompanied it the natives use the skulls of their deceased relatives for drinking cups, putting dried grass into the interior to act as a filter. This cup was given to the Oxford Museum by R. Davenport, Esq.

The second drinking cup was taken at the attack on Pekin; it is a calvaria, edged and entirely lined with copper or bronze. When found it was filled with spirituous liquor. The outside is very handsomely ornamented with gilt copper.

The third is also a Chinese calvaria drinking cup, now entirely plain and without ornament, but originally it was set in gold. It was given to the Oxford Museum, by Dr. Millar. See the 'Journal of the Ethnological Society,' vol. ii. page 82, 1869.—[Tr].

DESCRIPTION OF THE TWO 'EINBAUM' CANOES FOUND AT VINGELZ.

BY M. EDMUND DE FELLENBERG.

THE drawings of the two 'Einbaum' canoes (sometimes called in America 'dug-outs') taken up from the bottom of the lake, near the shore at Vingelz, are on the scale of $\frac{1}{50}$. The larger canoe is given in its entirety, looking down upon it from above and also in section. Some details are drawn to a scale of one in twenty-five, see Plates LXXXVI. figs. 1 to 6, and LXXXVII. figs. 1 and 2. The measures were all taken very exactly, and what does not exist in the original is given in dotted lines.

The large canoe at Vingelz has been long known, and the late Colonel Schwab had the intention of raising it up from the lake, when the water was then 8 or 10 feet deep, but desisted on account of the apparent impossibility of getting it up whole as it was entirely filled with heavy clay, and only the outer edges were to be seen projecting from the muddy bottom. But now, as in consequence of the drainage works, and the low level of the water this autumn, the shore at Vingelz was laid bare, it was found practicable, after the muddy shore had dried for some days, to reach the canoe dryshod, and a resident at Vingelz immediately began to clear it from the mud by digging round it. Dr. Lanz and Dr. Kramer, of Bienne, who at once went to the place on hearing of the discovery, gave me information of it, on which I immediately went there, and found that the canoe had been already partially cleared on the broader side, and that one part had suffered considerably from exposure to the sun and the curiosity of numerous visitors, consequently it appeared high time, if it were to be preserved in the interest of science, to begin a regular excavation. The labourers were supplied by the commissioners for the drainage, and under the direction of the writer this giant stem was dug up on the 5th and 6th October, and with very great difficulty carried to Bienne, where the several pieces were arranged on a wooden stage in a cellar of

Colonel Schwab's museum, and were then fastened together and secured by cramps. The immense weight of the whole boat (it was estimated by the carrier who took it to Bienne at from three to four tons), and also of its separate pieces, made it very difficult to put together, and a whole week was spent before the work could be completed. As the canoe was more than 43 feet long, and as the cellar under the Schwab museum was little more than 40 feet long, about 3 feet of the canoe had to be sawn off before it could be placed there.

The following are the dimensions of this canoe:—

From the extreme end of the stern, as at present existing, to the point of the bow, 43 English feet; but as the point of the bow is not in perfect preservation, 43¼ feet English may be considered as its length, see Plate LXXXVI. The hinder part is cut out very regularly in the shape of a half-moon, and it has a hole bored through it, 5 or 6 inches in diameter, which is stopped by a plug. The stern also is strengthened by a strong rib cut out of the solid wood, which, however, only makes the bottom stronger, for it does not reach to the sides, Plate LXXXVI. figs. 1 and 2.

The bow of the canoe finishes elliptically in the form of a spoon; it is narrower than the stern, and the wood is weaker, the sides are lower, and they join gradually together at the point, Plate LXXXVI. fig. 4.

The front part of the boat, for about a third of the whole length, has the sides strengthened by four ribs, the first of which (that nearest the bow) only strengthens the bottom, and does not extend to the sides; the second, third, and fourth ribs are at unequal distances, and are the strongest at the bottom, but grow narrower as they come near the sides, and they have small ledges, on which the rowing thwarts were fastened. These ledges and also the ribs were cut out of the solid wood; they are nearly 2½ inches below the gunwale, Plate LXXXVI. fig. 5. The distance from the point of the bow to the middle of the first rib is 3 feet 3 inches English; from the first to the second rib 2 feet 5½ inches; from the second to the third rib 3 feet; from the third to the fourth nearly 3 feet 2 inches. Or, taken together, the distance from the point of the bow to the middle of the fourth rib 12 feet English, or nearly so; from the fourth rib to the point of the stern 21 feet 3¾ inches, or rather more. From the point of the stern to the middle of the great hinder rib the distance is 4 feet. The breadth of the canoe measured over the sides between the great stern rib and the edge of the stern, and consequently about two feet from it, is 3 feet 5½ inches.

	Feet	inches.
The greatest breadth measured over the great rib is	4	4
„ „ in the middle of the canoe	4	4
„ „ measured over the fourth rib	4	3
„ „ „ „ third „	4	1¾
„ „ „ „ second „	4	0
„ „ „ „ first „	3	9
The depth inside the canoe at the great rib is	1	9¼
„ „ „ fourth „	1	5¾
„ „ „ second „	1	4¾
„ „ „ first „	1	2
The width inside measured at the bottom near the great rib	2	8
„ „ „ „ in the middle of the boat	2	11⅓
„ „ „ „ near the fourth rib	2	10¼
„ „ „ „ „ second „	2	7¾
„ „ „ „ „ first „	2	5⅓
Diameter of the ribs with the thwart ledges—		
Fourth rib—broadest measurement on the bottom	0	4⅛
Narrowest measurement under the ledges	0	2⅓
Length of the thwart ledges	0	6⅓
Thickness of „	0	6⅓
Third rib—Broadest measurement on the bottom	0	3¾
Narrowest under the thwart ledges	0	1¾
Length of the thwart ledges	0	7¾
Thickness „ „	0	2⅓
Second rib—Broadest measurement on the bottom	0	4⅛
Narrowest measurement under the thwart ledges	0	2⅓
Length of the thwart ledges	0	8¾
Thickness „ „ nearly	0	3
First rib, without thwart ledges—		
Narrow end at the side of the boat	0	3¾
Broadest part at the bottom	0	4¾
Diameter of the great stern rib	0	4¾
Height of the great rib above the bottom	0	4
„ „ other ribs „ „	0	2¾
The ribs project from the sides under the thwart ledges	0	1⅛
Thickness of the bottom at the stern, nearly	0	6
Distance of the bottom from the outer edge of the stern	0	16¾
The height of the vessel taken outside from the outermost edge of the side best preserved to the outer side of the bottom—		
At the great rib in the stern	2	3⅛
In the middle of the canoe	2	2
At the fourth rib	1	10⅓
At the second rib	1	8
At the first rib	1	3⅓
Thickness of the sides—At the bottom	0	4
In the middle	0	3¾
Above at the edge, from 1¾ to	0	2¼
Over the ribs	0	8¾

Thickness of the bottom at the great rib 3¾ inches; in the middle of the boat rather more than 3¼ inches; nearer the bow 4¾ inches; lastly, the measurement of the stern or hinder part at the edge 8¾ inches, and the thickness at the end of the bow 4¾ inches.

The canoe appears to have been originally imperfect, for a crack which ran the whole length from one end to the other had evidently been kept together in olden times by *iron* cramps, which were quite necessary. Four of these cramps were visible in the fork of the great crack towards the stern, and there were eight more along the whole length of the vessel at the bottom, most of which, however, were broken, and only a small bit of bent iron remained. These narrow cross cramps are from 4 to 7 inches long, and only 4¼ to 5 English lines thick, consequently they are extremely weak for keeping together such heavy masses of wood. They are very neatly worked and sharpened, the parts bent round are from 3 inches to 3¾ inches long, and as they were so weak most of them had broken in the bend. From the general appearance of these iron cramps—the working of which reminds one of the iron wares of Bevaix and la Têne—and also from the change in the character of the oak-wood, which had become coal-black, like the wood of the 'Brown-Coal,' and, lastly, from the 'pirogue'-like character of these canoes, I believe that we may consider the date of their manufacture to be that of the pre-Roman iron age, for both the Romans and the earliest middle-age people would have repaired a defective boat with very different iron appliances so as to make it useful again, while in this canoe the iron evidently had been used sparingly on account of its rarity.

When I was engaged in excavating the large canoe at Vingelz, I was informed by one of the visitors, of the stem of a tree apparently cut into a conical form and projecting but little from the bottom of the lake; it lay about thirty paces on one side of the great canoe. When we had secured the large boat I had this conical stem uncovered, and found, to my no small delight, that we had very unexpectedly fallen in with a second canoe, for the conical piece of wood soon appeared as if cut off smoothly above, and after a few minutes' work we brought to light the complete sides of a small but still perfect 'Einbaum' or 'dug-out' canoe. I had the whole canoe carefully uncovered, and there were so many peculiarities in it that it may be considered as one of the most interesting boats of its kind. It lay with its massive conical end towards the lake, tolerably parallel with the great canoe, and, like it, nearly a hundred feet distant from the ancient bank, that is, from the vineyards below Vingelz, Plate LXXXVII. figs. 1 and 2. The massive conical end was the highest part, and the canoe sank gradually into the mud, so that the other end was buried two feet deep. This canoe had one remarkable peculiarity. At the hinder part it is cut off quite square, both sides and bottom, and about 8 inches from the end a board about an inch thick and worked with the hatchet is fastened in on the bottom and between the sides as a kind of makeshift. It seems from this, either that the front portion of this primitive boat had, by some accident, been destroyed, and that the canoe had been made again available by the insertion of this board instead of the stern part, or that the stern portion of the boat, in its usual rounded form, had never existed, and that this singular arrangement was the intentional termination of the boat. In the latter case it is difficult to understand the prolongation of the bottom and sides for 8 inches, or the additional thickness of the wood just at this end from about the fifth rib down to the part cut off. One would almost have thought that this was the middle of the canoe, Plate LXXXVII. fig. 2.

The canoe, in its present state, is a trifle more than 19 English feet long, from the extreme point of the conical end to the part cut off. The circumference is somewhat round, so that the sides project beyond the bottom and slope very gradually downwards, thus the boat has somewhat the shape of a trough. It is strengthened at the bottom by five cross ribs, which rise nearly 2½ inches from the bottom, but do not reach the sides. There is a peculiar beak-shaped projection in the massive conical bow which stretches about 8 inches into the hollow of the canoe and divides the extreme end into two parts. The sides are very thin at the edge, and this is also the case with the bottom, except near the part where it is cut off, where it is twice as thick as elsewhere.

It was unfortunately impossible to preserve this very perishable canoe, as it was of poplar, and fell to pieces as soon as it was exposed.[1]

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[1] It is interesting to notice that the Ostiacks, on the river Obi, at the present day use canoes cut from a solid trunk of poplar. See account of Prof. Milne's Journey Across Europe and Asia, 'Geol. Mag.' No. 160, Oct. 1877, p. 462. Within the last few weeks I have seen and taken the measurements of several 'Einbaum' canoes at the lake of Alt Aussee in Austria.—[Tr.]

The following are the dimensions of the boat:—

Entire length, 19 feet 1 inch English. From the point of the projection to the first rib, 4 feet 7½ inches; from the first to the second rib, 3 feet; from the second to the third rib, 3 feet 6½ inches; from the third to the fourth rib, 3 feet 5½ inches; from the fourth to the fifth rib, about 2 feet 8 inches; from the fifth rib to the board, 1 foot 5¾ inches; from the board to the part cut off, about 8 inches.

Height of the ribs above the bottom, 2 inches to 2⅓ inches. Length of the massive bow, about 1 foot. Length of the beak-like projection, about 8 inches. Thickness of the bottom, 1⅙ inch to 1¾ inches; at the hinder part 3½ inches. Thickness of the sides towards the bottom 2⅓ inches; towards the top, 1⅙ inch.

Breadth of the canoe:—Above the massive bow, 1 foot 10½ inches; at the first rib, 1 foot 11¾ inches; at the second rib, 2 feet 2 inches; at the fifth rib, 2 feet 1 inch. Height of the edge of the sides above the bottom, in other words the total height of the canoe, 1 foot 1 inch forward; 1 foot 2 inches in the middle, and about 1 foot behind.

If we ask the age of this interesting boat it will itself return the answer. For in fact we found lying on the bottom in the middle of the canoe, a quantity of pieces of pottery belonging to three different earthenware vessels. This pottery is of half-baked clay in two instances, mixed with a quantity of quartzose sand. One has the edge ornamented with impressions similar to those common at Nidau Steinberg and Möringen. One piece belonged to a shining black thin vessel, and very decidedly indicates the *Bronze age*, and to this age we may consider the canoe to belong. It may probably have hailed from Nidau Steinberg.

CORTAILLOD.

This settlement is of considerable extent; it probably covers three acres. When the lake is low, the depth of water is about seven feet; in ordinary times from nine to twelve feet. The locality goes by the name of Pervou. It is very rich in bronze objects, of which Colonel Schwab, Mr. Otts of Neuchâtel, and M. Troyon possess a considerable quantity, such as armlets and earrings, swords, lance-points, sickles, knives, and hatchets or celts; also several objects of iron, such as knives, shears, daggers, and arrow-heads. Besides these, there are stone celts, corn-crushers, what are called slingstones, and mealing-stones. Earthenware vessels, rings, and spindle-whorls are found here. On the whole, this settlement appears to have been of later date, like that of Estavayer, and probably to have been inhabited about the same period.

Amongst the specimens which were procured in 1862 from this place by Colonel Schwab, the following are probably of the greatest interest:—

An earthenware dish or plate, about sixteen inches in diameter, ornamented with strips of tin. It is drawn about half the full size, Plate XCI. fig. 5. The lid of an earthenware vessel with strips of tin pressed on its surface was found at Estavayer, Plate XCVI. fig. 1, and one or two other specimens, ornamented in a similar way, have been met with, amongst which is that lately found here, and drawn on Plate CXL., but perhaps no example of this peculiar and remarkable manufacture has occurred in such beautiful and perfect condition as the specimen under consideration, Plate XCI. fig. 5. The ornamentation consists of plates of tin as thin as paper, which form a striking contrast with the black ground of the vessel. These thin plates are also ornamented with impressed lines, which after the plates were fixed were engraved or indented with a blunt style. By means of this additional work, the tin, which apparently was simply pressed into the earthenware while yet soft, was made to adhere more closely to the clay. The ornamentation consists of a rosette in the middle formed of quadrangles, which is surrounded by a band of a pattern similar to that called the meander, which is so commonly found on the earthenware vessels of the bronze period from the lakes of Neuchâtel and Bienne, and also from Ebersberg.[1] A pattern somewhat similar is also found on one vessel from Wangen on the lake of Constance. This dish was made by the hand alone; the material is a dark-grey clay, blackened by graphite: the lower figure shows a section of this singular vessel.

Figs. 1 and 2 of Plate CXL. represent the very remarkable vessel above referred to, ornamented in a somewhat similar manner. Like most of the antiquities described from this locality, it is in the collection of the late Colonel Schwab. The ornaments on the upper part of it consist of thin strips and plates of tin pressed into the clay. They are executed in a kind of 'graffito' manner: the parts left white represent the tin ornaments; the black is the original colour of the earthenware.[2]

Amongst the bronze objects many are of the highest interest, and none more so than the wheel drawn Plate XCII. figs. 4 and 5; it probably belonged to a war chariot (essedum), and as far as mechanical skill is concerned is a specimen of very excellent 'hollow casting.' The middle portion of this wheel consists of a hollow ball, from which radiate the four spokes also hollow. The spokes diminish rather conically towards the felly, and both on the outside and inside have a kind of ridge running along their whole length. Where they join both to the nave and also to the felly, they are strengthened by supports or bases, in the shape of triple rings. The circumference of the wheel is made as it were of a hoop bent up at the sides, the spokes being fastened to the back, and the space between the two cheeks or sides was filled up with a wooden circle of fellies, which were fastened on each side by nails. These wooden fellies may probably have projected far beyond the metal casing, just as we see similar instances represented in Assyrian sculptures. An axle-box of 3½ inches in diameter projected from one side of the nave; about 2½ inches of it were visible. It is ornamented with a hoop or ring quite at the end, and with another not far from the nave, between which there was the same ring-like arrangement as at the ends of the spokes, and also as an ornament on the central boss. The whole wheel had been cast in one piece, but unfortunately when the settlement was burnt, it was partially melted by the heat.

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[1] The pattern on this dish, as shown in Plate XCI. which is a 'transfer' received from Zürich, differs slightly from that originally published. Of course the later drawing is the more correct.—[Tr.]

[2] 'Graffito' is a mode of mural painting well known in Italy, and possibly also used in England. The wall is first painted with a coat of black, and afterwards with one of white; a drawing is then made on the white coat, and portions are scraped away so as to show the black beneath. In the earthenware vessel above described, the ornamentation did not consist of tin strips and plates of equal size, but one large thin plate, or what would now be called a sheet of tinfoil, was laid on the black ground, and then scraped off by a point or a knife from those parts required to be black.

If we call to mind the numerous works of Etruscan art which are found in Switzerland, as, for instance, the vase of Grächwyl, the speculum of Avenches, the numerous bronze statuettes, and many of the specimens described in the present volume, we may probably consider this wheel as the product of an Etruscan workshop.

Plate XCII. fig. 1 is the neck of a bronze casting broken off when the operation of the founder was completed.

Plate XCII. figs. 2 and 3; Plate XCIII. figs. 4 and 10; and Plate XCIV. fig. 25, are bronze armillæ: the arrangement of the lines on the three last which form the ornamentation are especially worthy of notice. Fig. 9 in Plate XCIII. shows the section of the armilla (fig. 3, Plate XCII.). The specimen of which two views are given (Plate XCIII. figs. 6 and 7) is a portion either of an armilla or of a ring made of very thin bronze; three perforations form a part of the ornamentation.

Plate XCII. figs. 6, 7, and 8, and Plate XCIII. fig. 8, are what are called crescents of bronze; these specimens will be especially referred to in the chapter on crescents.

Plate XCII. fig. 9 is a bronze arrow-head.

Plate XCIII. figs. 1, 2, and 3, are bronze implements for suspension.

Plate XCIII. fig. 5 is a massive bronze ring ornamented with engraved concentric circles; it has four holes in it, which originally were filled with stones of various colours.

Fig. 13 is a bronze hook.

Fig. 15 is an earring of bronze with a drop of earthenware.

Plate XCIV. figs. 13 and 21 are bronze pins. Of the large number of pins found in the lake dwellings some were solid, others were hollow in the head, and in some cases there were perforations in the heads at regular distances which apparently had been filled with tin or stones of various colours. The head of the pin drawn fig. 21 is peculiar, not merely from its size, but from the mode of its manufacture; it is not cast, but consists of two hollow hemispheres of very thin bronze plate ornamented with rows of round projections or bosses made with the punch and then soldered together.

Fig. 28. An object in bronze the use of which is not known: it is hollow inside, and has the form of an hour-glass or double funnel.

Some objects of gold were found here, amongst which were six earrings of a similar pattern, one of which is drawn Plate XCIII. figs. 11 and 12. A thin plate of a pointed oval form terminates in a wire; the plate is ornamented with a series of raised lines, one within another.

Some bone implements were met with, amongst which may be mentioned the piece of bone (Plate XCIII. fig. 16) which has on one side a series of notches apparently worn by thread. An implement probably somewhat similar, notched, but polished by use, and which may have been used for netting or knitting, was found at Robenhausen, and is drawn Plate X. fig. 19.

Plate XCIII. fig. 14. A string of beads of bluish and white glass and of amber, similar to those found in tumuli.

Plate XXII. fig. 16 is a spoon of rather dark-coloured clay.

Fig. 19 is a piece of an earthenware vessel with three holes on each side of the handle, filled with little plugs of wood.

Figs. 31 and 32. Earthenware vessels, the bottom perforated like a sieve. Fig. 34. Part of the rim of an earthenware vessel, with knobs, one on each side of the handle, for the convenience of placing the thumb, like some of those from the Terramara, drawn Plate CXIII.

Figs. 26 and 30 are bronze ornaments. Fig. 33 is a bronze sickle, with a little knob, Fig. 35, near the bottom of the blade, to assist in fastening the handle.

Plates LXXX. figs. 1 and 2, and LXXXI. figs. 1, 6, and 11, are drawings of perfect and imperfect crescents of earthenware of different patterns. Respecting these singular objects, the reader is referred to the chapter specially devoted to them towards the close of the volume.

The cup, or what is called the strap, of a sling made of platted flax cords, was found here, and is drawn on the lower part of Plate CXXXVIII. This unique specimen will be described in the chapter devoted to the manufactures of flax and bast.

Fragments of the clay covering of the wattle-work which covered the walls of the huts have been found at Cortaillod. No piece, however, has yet been found in the lake of Neuchâtel of a greater diameter than a foot. Sometimes they are flat, sometimes more or less curved, as they fell into the water when red hot.

Corn, charred apples, acorns, nuts, fennel-seed, and peas have occurred here in several places.

The following specimens have been discovered here of late years and are now added in order to complete the list of antiquities.

Plate XLVI. fig. 2.	Bronze sword.
Plate XLIX. fig. 3.	Handle of sword.
Plate LIX. fig. 2.	Double button or stud of bronze.
Fig. 5.	Cutting implement or crescent of bronze.

AUVERNIER.

From the report of Professor Desor there were here two settlements, one of the stone and the other of the bronze age. With respect to the first, he says: 'I have discovered and investigated a regular "Steinberg" at Auvernier; it lies at the bottom of the bay, in fact in the most sheltered spot; it is about 340 feet distant from the southern bank, and 195 feet from the western shore. The area is nearly two acres, or about 76,000 square feet, and the whole of it is somewhat raised and covered with loose stones, varying in size from 2 or 3 inches to 1½ or 2 feet. The smaller ones are more or less rounded, and have been brought from the shore; many of the larger ones are still as angular as if they had been taken but yesterday from the quarry. There can be no doubt that these stones have been brought from Serrières or Neuchâtel, where the limestone rocks are washed by the lake. The piles stand on this flooring or layer of stones; none of them are less than 7 inches in diameter, and some measure 9½ inches or a foot across. The heads of many of them exhibit either projections or hollows, which may arise from the piles which were too high having been partially sawn through with stone saws at the required height and then broken off.

'Immediately behind this Steinberg the bronze station is found, the piles of which, however, are full 100 feet distant from it. They are very numerous, are driven into a bottom of muddy sand totally different from that of the "Steinberg," and are only 5 or 6 inches in diameter. They project from the bottom 1½ or 2 feet, and are arranged in such a manner as to form a zigzag line, and stretch towards the land in four, five, or even six parallel rows. The depth of water on the Steinberg of Auvernier is 6 feet, or somewhat less than on that of Hauterive, while the bronze station is 14 or 15 feet under the average level of the water.

'An oak canoe, nearly thirty feet long, is lying at the bottom in the bay of Auvernier which,' says Professor Desor, 'I mean to secure. The wattle-work which formed the covering or walls of the huts is lying on the bottom, and consists of poles from 2 to 2½ inches thick, at a distance of 2 feet apart. Rods 1 or 1½ inches thick are closely interwoven crosswise between these poles. Unfortunately this wattle-work is too rotten to be taken up from the bottom.

'From what has just been said as to the strength of the piles at these two stations, the conclusion that the piles of the bronze period were stronger than those of the stone period does not seem to be verified in this locality.'

Several antiquities found here are drawn on Plate XCIV.

Fig. 1 is a richly ornamented lance-head of bronze.

Fig. 2 is an armilla of cast bronze, ornamented alternately with zigzag or hatched lines and with lines encircling the body of the ring.

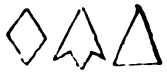
Fig. 23. Flint arrow-head, not barbed. Three different shapes of flint arrow-heads are found in the lake dwellings, thus: . That now drawn belongs to the first. The second kind, the most artistic of all, may be seen Plate XIII. fig. 13, and the mode in which it was attached to the shaft, Plate XXXIX. fig. 15. These are two views of a flint arrow-head with a portion of the shaft still remaining, the flint being fastened in a notch in the wood, the two sides of which were then secured and drawn tight by a cord. This specimen was not met with in a lake dwelling, and is merely introduced here to show the mode of attachment. It was found on the moor called Geissboden, on the ridge of the Zug mountain. The third sort is always made very sharp on the lowest or narrowest side of the triangle, to allow of its being fixed more easily into the cloven end of the shaft. The colour of these arrow-heads varies from clear yellow to black and dark red. Mineralogists consider these different varieties of flint to have been derived from the Swiss and the French Jura mountains.

Plate XCIV. fig. 26. An earthenware drinking-cup drawn in section; a hole runs through the narrow or middle part.

Fig. 27. A great bronze fish-hook.

Fig. 29. Horn-shaped vessel of coarse-grained black clay, with the point bent up. Auvernier is rather celebrated for the variety of earthenware vessels found here, and this appears to be one of the most singular. Its sides are very thin, and are ornamented towards the rim with engraved lines running round

the vessel; in these lines are five small holes, one above the other, going quite through. Similar vessels have been already described from Nidau, and have been found also in other stations. The Nidau specimen is drawn Plate XXXVIII. fig. 6. In describing it we ventured on the supposition that vessels of this kind were used for preparing cheese, the whey oozing out through these small holes. A fragment showing this peculiarity was found at Ebersberg on the mainland. See Plate CXLIV. fig. 5.

Plate XCIV. figs. 30 and 34. Very neat vessels made by the hand alone; the material is purified and blackened clay: they have a conical base, so that they were intended to stand in rings.

Fig. 31. A little two-handled pipkin, with four feet, made by the hand alone out of red purified clay and well burnt. The handles, the rim, and the feet are bordered with three furrows, and round the outer one runs a row of triangular impressions.

Fig. 32. Vessel made of very impure clay mixed with large grains of stone; the lower half is thickly covered with small projections more or less regularly placed, which may have been useful for taking hold of the vessel and keeping it firm in the hand. This arrangement is unusual.

Fig. 33. Earthenware vessel made by the hand alone; it has a large bulge, and is ornamented with the double Greek pattern (or meander line), which unfortunately is not well shown in the sketch. It resembles that on the fragment found at the settlement of Ebersberg, drawn Plate CXLV. fig. 1. A little above the base the side is perforated with three holes, the use of which is not known.

Fig. 35. A slab of granite, with a cup-like hollow about 13½ inches long, and 11⅓ inches wide; the depth of this hollow is 1¾ inch. The stone weighs 88 lbs. Several similar stones were found by the late Colonel Schwab in the lake of Bienne. They were used as mortars.

Fig. 36. Small bronze chisel in the collection of Professor Desor of Neuchâtel.

The above is all that was known about this settlement when the first edition of this volume was published. Since then the station has been carefully investigated by Dr. von Gross, and the following is his account, which was published in the 'Seventh Report on Lake Dwellings,' by Dr. Keller:—

The Lake Dwelling of Auvernier. By Dr. von Gross.

This settlement of the bronze age has been known for about fifteen years; it was mentioned in the Fourth Report of the Proceedings of the Zurich Antiquarian Association by Professor Desor. It is situated in the bay of the Lake of Neuchâtel, between Colombier and Auvernier. Its peculiar position, sheltered from the south wind, and from that called 'Ioran,' had been appreciated by the lake-settlers of the stone period. For there exists in this place, but nearer the shore, a considerable pile dwelling going back to this primitive period.

The piles of the bronze age settlement extend over a large area, larger, according to the fishermen, than that of the settlement at Möringen.

The depth of water above the piles is, on an average, from 10 to 13 feet, so that the investigations, which had to be carried on by the hand-scraper, were very difficult, and could only be managed when the water was calm. They began at the end of 1873, and have been regularly carried on up to the present day.

A glance at the number and importance of the specimens found in the relic bed will convince anyone that the station of Auvernier is unquestionably the richest and most considerable of all those hitherto examined in Switzerland. It has surpassed even the station at Möringen, which had hitherto been considered as the best representative of that flourishing period of prehistoric times, which has justly been called by Professor Desor, '*le bel âge du bronze.*'

The following is an account of the most interesting specimens found in this locality:—

I. ARMS.

Several bronze swords, some of which are of a new type, not hitherto known in our lake dwellings.

The first I will mention is a specimen made after what I will call the 'type of Möringen.' It is a sword with a massive stone handle, ornamented with rows of circular lines, and three raised bosses, one end having the cross-guard, and the other end terminating with an oval stud or button.

A second type, Plate XLVIII. fig. 2, the type of Auvernier, is an intermediate form between the sword with a flat tang, which, according to my idea, is the primitive type of bronze swords, and that with the massive handle, which is the most perfect and also the most recent. The blade of this sword differs only from those just described by having two dotted concentric circles placed at the commencement of the raised threads or lines. The handle is, in fact, flattened with an oblong excavation on each side, neatly shaped, and within which is fixed by three rivets a plate or slab of stag's horn. The cross-guards and the terminal stud have nothing remarkable about them. The latter, however, has an appendage about three quarters of an inch broad, and a quarter of an inch long, probably terminating in a kind of ring, like that drawn Plate LXXIII. fig. 10.

The sword, Plate XLVI. fig. 5, now in the museum at Neuchâtel is made on a similar type, only the centre of the handle, instead of being finished with stag's horn, has an oblong cavity running through it.

A fourth sword, found lately, exhibits such skilfulness in the art of casting bronze as could hardly have been looked for in the lake dwellings, Plate XLVIII. fig. 1.

The broad strong blade is notched or slightly hollowed out on each side, near the handle, and is ornamented with four pairs of raised lines, and with two little discs, made with points placed near the cross-guards.

The handle, which is tolerably large, and has large cross-guards, is made on a similar type to those previously described, which I have designated the type of Auvernier. And yet it is more perfect than the last, as the vacant space in the middle of the handle is not filled up with stag's horn, but with metal, which has been found to be pure copper. In the spirit of imitation, the workman has kept the rivets as ornaments, although they were not wanted. The oval plate, terminating the handle, is traversed by a square bar, which has a curious appendage of a navicular form, which apparently was made use of to fix a setting of wood or of horn, or to supply the place of a ring for suspension.

The different types of swords which I have just described are of the highest interest, as they allow us to follow the successive modifications of the sword handles from their origin in the bronze age till the appearance of iron. Thus, according to my view, there is no doubt that the primitive type is that of swords with a flat tang, intended to have a regular handle, either of wood or horn. Afterwards the horn gave place to metal, and only appeared under the form of an unimportant setting fixed by rivets. Then the horn disappeared entirely, and the handle became massive, still retaining the character of the type which had served as a model (copper melted into an empty space made in the handle, and bronze rivets). Finally appeared the perfect sword, represented by the type of Möringen, with a massive handle made of homogeneous metal, but still retaining vestiges of an earlier type, in the form of rounded projections imitating the heads of rivets.

Lance-heads are comparatively rare in the lake dwelling of Auvernier, hardly ten specimens have as yet been obtained. All were of the ordinary type, having a socket which is often ornamented with well-executed patterns, Plate XLVI. fig. 8.

II. IMPLEMENTS.

The celts and sickles found at Auvernier (about forty in number) exhibit nothing remarkable, and are of a type similar to those found at Möringen. I will only mention one little celt (Plate LIX. fig. 13), which has the socket ornamented with patterns.

About fifty knives were found, the blades were rather wide, and the backs often strengthened by a thicker rib, they all have a tang for fixing in the handle, with the exception of three specimens, in which the bronze handle, made of one piece with the blade, is elegantly ornamented, Plate L. fig. 6. One of the knives with a tang, Plate L. fig. 1, is remarkable for its elegant shape and ornamentation. The flat part of the blade has on both sides a line of festoons cut by the graver, and exactly following the curve of the cutting edge, while the back is covered by numerous series of striped lines, the uppermost placed as chevrons, the lower ones in regular series separated by inverted crosses.

Two specimens hitherto unknown appear to be connected with the knives; they have naturally excited the curiosity of antiquarians.

They consist of small pieces of bronze, Plate LVIII. figs. 7 and 8, about two inches long, more or less of a cylindical form, with a ring for suspension at one end, and at the other a series of appendages, almost like the prongs of a fork. By means of these appendages the piece of bronze was fixed to the end of the horn or wood, which formed the handle of the knife. If these specimens were thus used, and it is easy to convince oneself of this by comparing them with the handle of the knife drawn Plate L. fig. 5, we shall then find amongst the knives a regular series of types corresponding with the series (of types) of swords mentioned above. Thus we have first the primitive type—the knife with a tang; then this type improved—the knife with the stag's horn handle, ornamented with bronze; and, lastly, the perfect type, represented by the knives with solid handles, made of one piece with the blade.

It has been imagined that the little bronze cylinders, Plate LXXI. fig. 3, may have been knife-handles, but I think they may rather be considered little cases for keeping small objects of the toilet, such as pins and needles. In fact, in the Lake of Bourget, and at Möringen, similar cylinders have been found still containing implements of this kind.

About twenty socketed chisels were found at Auvernier, many of them remarkable for their great size and elegant workmanship. Plate LV. fig. 1, which has been used as a gouge, and is about six inches long, has a square socket, on each of the four faces of which there are ornaments, in the form of furrows and curved scallops. Two others, figs. 3 and 4, are smaller, and have the socket rounded. Another specimen is interesting, having been made out of a damaged knife.

Four hammers were found, all with a square socket—the largest, Plate LV. fig. 5, is nearly 2½ inches long, and weighs nearly 10 ounces avoirdupois. Another, fig. 9, has a lateral loop or ear, and on one of its faces it is ornamented with three little rounded studs.

The anvil, which is an indispensable accompaniment of the hammer, has lately been met with in this station. While at Möringen and elsewhere it was made out of a hard stone, ground down and widened on one of its faces, at Auvernier it was an improved instrument made of metal. It is a piece of massive bronze (Plate LV. fig. 7), weighing nearly 10¾ ounces English, having somewhat the form of a wedge tapered at one end, so as to go into a piece of timber, and having the other end slightly convex and very smooth, in the form of a low square about 2 inches long, and rather more than an inch broad. This is, I believe, the first specimen of a bronze anvil which has been hitherto found, either in the lake dwellings or in the tumuli.

I have still to mention in this division another specimen, which probably was used by the founder to make the heads of hairpins. It is a plate of solid bronze, 1⅙ inch long, ¾ inch wide, and ⅕ inch thick, perforated with three round hollows placed regularly, intended to hold the stem of the pin. In this way the head would be held firmly above the opening, and could be ornamented and worked with ease.

Amongst the implements may probably be placed the piece of carved wood, drawn Plate LXXXIII. fig. 3. It is unique, and its use is unknown.

III. OBJECTS BELONGING TO DRESS.

Amongst the specimens of this class found at Auvernier, the hairpins take the first rank, both on account of their number (about 200 specimens) and their variety. They have been found of all sizes, from one, two, or three inches up to sixteen inches in length.

About ten specimens have a solid spherical head, elegantly ornamented and dotted, having circular hollows around them, which are generally filled up with thin plates of bronze, of lead, and more rarely of gold, Plate LXI. fig. 3. The inside of the head is filled either with metal, or with a resinous matter which looks like asphalt.

With respect to the rings for the arms and legs those found at Auvernier are by no means inferior to any found at Möringen, either in their number or in the beauty and elegance of their form. About sixty have been found up to the present time. The Plates LXII., LXIII., LXIV., LXV., LXVI., and LXVII., represent the finest specimens. Plate LXIII. fig. 2, was made of hammered bronze; it is hollow inside, ornamented with concentric circles, joined together by a series of oblique lines, producing a kind of network very pleasing to the eye.

Plate LXIII. fig. 3 is a neck ring or torque, the section of which is square; this type is very rare in the lake dwellings.

Plate LXII. fig. 3 is remarkable for its original design, the external surface being ornamented with concentric circles and transverse striæ.

Plate LXII. fig. 4 is interesting on account of its form and ornamentation; the section of it is nearly a triangle.

Plate LXV. fig. 6 is formed of two bands of twisted wire, joined by a smooth band: it is somewhat similar to Plate LXIV. fig. 5, which is from Möringen. Plate LXIV. fig. 4, and LXV. figs. 3, 4, and 5, are solid bracelets ornamented with different patterns. Plate LXIV. fig. 3 is elegantly ornamented. Plate LXVII. fig. 5 is a little solid bracelet, which has belonged to a child. Plate LXVI. fig. 1 is remarkable for being ornamented both within and without. Plate LXVII. fig. 2 is a very handsome bracelet, and figs. 3 and 4 are hammered bracelets beautifully ornamented.

In concluding this list of objects of dress, I may mention a number of rings and pendants, Plate LVII. figs. 2, 3, 8, and 10, similar to those already described from Möringen; an earring beautifully worked, Plate LVIII. fig. 1; a bronze finger ring, drawn Plate LIX. fig. 1; and a necklace ornament of stag's horn, perforated lengthwise for suspension, and ornamented with dotted circles, Plate XLIV. fig. 2.

Lastly, I may mention a very singular specimen, most skilfully made, and which, though without any ornament, belongs to the same category as the specimens just described, (Plate LVII. fig. 4). It is a little hollow cage of cast bronze, the form roundish, with open spaces quite through it, very skilfully managed; it reminds one rather of the form of a sheep's bell divided into two segments, the larger of which (the lower one) looks like a kind of cap or calotte, nearly two inches and a half in diameter—the upper one somewhat resembles a covering or lid to it. The lower or supporting segment has around it sixteen little appendages or ribs, nearly half an inch long, which correspond with the same number of ribs on the lid or cover. On the latter there is at the top a solid stem terminated by a ring for suspension, and it is ornamented under the ring by a number of raised lines running round it. The two pieces had been cast separately, which may easily be proved, as the ribs of the top and the bottom do not exactly coincide.

Was it possible that the two halves were by some means joined together so as to form a bell? It is very difficult to decide this. I should rather be disposed to consider it as a vessel used for burning perfumes (cassolette).

IV. OBJECTS BELONGING TO HARNESS.

No specimens of the more perfect horses' bits, such as those obtained from Möringen, have yet been found at Auvernier. On the other hand, not to speak of the perfect horse's skull, of which full particulars will be given by Professor Rütimeyer in the present volume, we have found several specimens belonging to harness, which leave no doubt as to the existence of horses in our lake dwelling.

The following are some of these specimens, Plates LXX. and LXXI:—

1. Two cheek bars of a bit made of stag's horn like those of Möringen.

2. Two mouth bars, Plate LXX. figs. 3 and 4, of cast bronze, remarkable for their small size—the smaller bar is hardly 2½ inches long.

3. A very curious specimen, Plate LXXI. fig. 1, in the shape of a helmet in miniature—it probably was fastened to some part of the harness by the four rivets which may still be seen upon it.

4. Several phaleræ or large studs, Plates LXXII. and LXXIII., hammered out with much skill, and varying in size from 2 to 6 inches in diameter. Some specimens of the middle size, Plate LXXII. figs. 1, 2, and LXXIII. fig. 3, are ornamented with concentric dotted circles; in the case of the two first these circles are joined by bands of straight lines: they more probably belonged to the dress of a warrior than to the accoutrements of a war-horse. Two flattened counters, Plate XLIII. fig. 13, made of elk's horn, are ornamented with the same patterns and perforated in the centre.

V. MOULDS.

Though not like Möringen, which may be called a centre of industry, yet the station of Auvernier has furnished several moulds for casting; the following is the enumeration of them:—

1. A mould for a sickle made of 'molasse' rock, exactly like those of Möringen, already described.

2. A portion of a mould for a lance-head, also made of molasse.

3. Several fragments of moulds for bracelets made of baked clay; one of them Plate LXXV. fig. 2, is of a peculiar pattern, it would probably have made a bracelet like that drawn Plate LXV. fig. 1.

VI. POTTERY.

No other lake dwelling has as yet equalled Auvernier in the number of perfect and well-preserved earthenware vessels. I believe that from four to five hundred specimens from this place are to be found in various museums. In general they consist of cups, dishes, and plates. Only a few specimens were found of cups with a conical base which required clay rings to support them.

A large dish, with the edges spread out, is interesting, as it reveals to us the mode of manufacture employed by the potter.[1] On the external surface may be noticed very distinct horizontal lines of demarcation, which indicate the different stages of the manufacture.

It is probable that the workman after having formed the bottom of the vessel let it dry, and then successively raised the sides of the vessel by adding a fresh layer of clay, and so continued till the edge was of the required height.

Many cups with spreading borders or edges, and in general ornamented with patterns on the inside, are furnished with a foot neatly fashioned.

A curious little vessel, Plate LXXIX. fig. 6, which has two cylindrical appendages, each of which apparently was intended to support a similar vessel. These cylinders are perforated, and this would form a communication between the three vessels. Had this specimen any practical use, or was it simply a child's toy?[2]

Several oval vessels may also be mentioned, see Plate LXXVIII. fig. 5; they stand on a kind of foot or pedestal, and the surface is perforated. Probably they were playthings.

A number of plates and dishes covered on the inside with a variety of patterns.

A round stone which apparently has been used as a mould for making little cups,[3] Plate LXXVII. fig. 11. This is the first specimen of the kind found in the lake dwellings.

In conclusion, I may mention a little clay figure, tolerably well modelled, which has some resemblance to our common mole, Plate LXXVIII. fig. 1; also a number of spindle whorls in baked clay, ornamented with all kinds of patterns, Plate LXXXV.

Besides the numerous antiquities described by Dr. von Gross a large number of other specimens were obtained, some of which have been drawn in the following Plates :—

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[1] The same plan is still used amongst some savage nations.

[2] It is rather singular that our modern potters have lately introduced china flower vases of a pattern almost identical; the chief difference is that the modern vessels are more globular, but all the three communicate together.—[Tr.]

[3] I have found about twenty of these cups, all of which exactly fit the above-mentioned mould, so that there can be no doubt as to its use.

Plate L.	Fig.	5.	Knife, with the handle ot bronze.
„ LI.	„	2.	Ornamented bronze knife.
„ LV.	„	4.	Bronze chisel.
	„	6.	Bronze hammer.
„ LVII.	„	7.	Bronze ornament.
„ LVIII.	„	14.	Ornamented bronze plate.
„ LIX.	„	17.	Bronze ornament for suspension.
„ LX.	„	3.	Bronze hairpin.
„ LXI.	„	6.	Do.
„ LXIII.	„	1.	Bronze armilla.
„ LXVI.	„	6.	Bronze armilla or ring.
„ LXIX.	„	2.	Hollow bronze ring ornamented with lines.
„ LXXIII.	„	5.	Bronze ornament.
	„	9.	Do.
„ LXXV.	„	4.	Perforated stone.
„ LXXVI.	„	2.	Ornamented earthenware vessel.
	„	3.	Ornamented pottery.
	„	4.	Do.
	„	5.	Ornamented earthenware vessel.
„ LXXVII.	„	6.	Part of a clay ring.
	„	7.	Do.
	„	10.	Pottery ornamented with circles.
	„	12.	Perforated stone, use unknown.
	„	13.	Part of an earthenware 'cullender.'
„ LXXVIII.	„	2.	Child's toy (earthenware) in the form of a bird.
	„	6.	Earthenware cup.
„ LXXIX.	„	4.	Child's earthenware cup.
„ LXXXIII.	„	3.	Wooden implement, use unknown.

THE LAKE-DWELLING TOMBS AT AUVERNIER.

Notwithstanding the great development in prehistoric knowledge arising from the active and continuous researches carried on for years amongst all our pile dwellings, one problem still remained unsolved, and probably would have long continued so, had it not been for the fortunate chance which forms the subject of this present notice.

In fact, till now, we had but vague and confused ideas as to how the lake dwellers disposed of their dead, and people were driven to conjectures more or less probable.

Some authors[1] supposed, and with reason, that the mode of proceeding in those ages was the same as that of to-day, and that the lake dwellers must have possessed in the neighbourhood of the pile dwellings places appropriated to sepulture, where they deposited the remains of those who had gone to the other world. This, however, was only a supposition, for till now nobody had ever found, either on the banks of the lakes or on the piles near the settlements, any places of sepulture which could be supposed to go back to such a remote period.

Others thought that possibly cremation might have been in use both in the stone period, and also till the end of the bronze age. But in this case, we certainly should have found proofs of it in the neighbourhood of the settlements, which we have never done as yet.

Lastly, there remained the alternative which was least admissible, that the lake-dwellers simply threw their dead into the water,[2] a mode of proceeding which has never been adopted by any people, and which is in direct opposition to the respectful reverence paid to the dead by all the nations of antiquity.

The question is now decided, as it has been proved by the discovery of a general tomb, near the station of Auvernier, that the lake dwellers interred their dead on the mainland near their abodes.

The following is the account of this discovery, which is especially important from the facts it reveals to us as to our prehistoric population.

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[1] See Desor 'Le Tumulus de Favargettes,' page 2.

[2] We certainly have found amongst the remains of several of our pile dwellings (amongst others Lüscherz, Möringen, Auvernier, and Sutz) isolated skeletons which belong to the age of the lake dwellings; but the fact of their having been found in the middle of the piles evidently arose from accidental circumstances, and was a natural consequence of the numberless tragedies (battles and conflagrations) which must have taken place again and again in these localities.

On Sunday, the 23rd January, this year, I heard from M. Chautems, of Auvernier, that the workmen employed in digging the foundations of a house, in a vineyard, opposite the pile dwellings, between Colombier and Auvernier, had discovered at the depth of about six feet some great flagstones, under which were found human bones. See Plate LXXXII.

Being anxious to verify with my own eyes the contents of this letter, I went immediately to the place, and I ascertained that there was no doubt as to the existence of a tomb[1] formed of large flagstones or slabs placed upright, and filled inside with loamy clay mixed with bones and great stones. The large slab which had formed the covering was 5 feet 3 inches long, and 4 feet 3 inches wide; it had already been removed, and the hole had been emptied to a depth of about 16 inches, without finding anything but human bones, chiefly broken, mixed with earth and pebbles, so that there was nothing then to enable us to determine the approximate age of the tomb.

As the proprietor of the ground did not seem disposed to collect these remains and to excavate the tomb with all the necessary precautions, I offered to take charge of it myself, and on the following day the men set to work under the direction of M. Chautems, and at the end of three days had finished their labours. The excavation of the sepulchral chamber had to be made with very great care, for the skeletons were found in the middle of a bed of hard tough earth, and the various bones, more especially the skulls, were so fragile that they fell to pieces if handled at all roughly.

The tomb when cleared out was 5 feet 10 inches deep, 5 feet 3 inches long, and about 3 feet 8 inches wide, surrounded on every side by large flagstones made of the Alpine erratic blocks (granite and gneiss), and coarsely wrought. The largest of these slabs was 6 feet 3 inches long, 6 feet broad, and 11 inches thick. The bottom of the hole was not formed, as is frequently the case in tombs, of a slab of stone, lying horizontally, but simply of a bed of gravel, which is about 2 feet higher than the actual level of the lake.

The axis of the tomb is at right angles to that of the lake (from NE. to SW.), so that a body placed in it would have had the face turned to the lake dwellings.

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[1] It is situated in a vineyard called '*plantée de rive*,' about 50 feet from the road which runs alongside the lake, and about 170 feet from the shore. It lies at right angles to the road.

The tomb is closed in front and behind by a single large slab placed upright. The slabs forming the sides are kept in their place by a second row of slabs placed close to them, and on the outside of these are placed large stones to keep them upright. One of these slabs, situated on the west side, is of granite, from Mont Blanc, and was 6½ feet long, 6 feet wide, and 11 inches thick; it was entirely disintegrated, and fell to pieces. This fact shows that it had remained a very long time underground.

The great gneiss slab which closes the southern entrance of the tomb, is 5 feet 7 inches high, and 3 feet 9 inches wide. It has one peculiarity worth mentioning. At one of its upper angles (on the eastern side) there is an opening more or less square, apparently made intentionally, sufficiently large to allow a human body to have been carried through.[1] By means of this opening there was a free communication between the vault and the anterior passage I am about to describe.

For I ascertained that, besides the principal median vault which contained the greater part of the skeletons, there were two kinds of accessory chambers, one on the north and the other on the south of the main chamber, and joined to it. Figs. 1 and 2 of Plate LXXXII. gives the ground plan and the perspective view of the tomb.

The posterior chamber—that on the north side—is backed by a great block of granite, and covered with two small slabs; it is 2 feet long, by about 44 inches wide. It was entirely filled with earth and stones, and contained two skulls and some scattered bones.

The anterior chamber—that on the south—in front of the principal entrance, is not covered with stone slabs; the shape of it was that of a corridor or passage more than 5 feet long, intended as an entrance to the sepulchral chamber. The two sides of this passage are formed by two great slabs placed upright, and the entrance is closed only by a little block of limestone and by some large stones. No human remains were found there. The three rooms, as well as the spaces between the slabs, were filled with earth and large pebbles.

With respect to the contents of the sepulchral chamber, I think that I am not deceived in estimating the number of skeletons contained in it as from fifteen to twenty. They were all laid in a certain order. The skulls were found in general in the northern portion and at the angles of the vault, while the bones of the trunk and of the extremities were placed in the middle. The best preserved skulls were found at the bottom, while those above had been more or less damaged. They were all filled with earth and small bones, amongst which I recognised several remains of the hands and feet.

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[1] Can this have anything to do with the 'holed' stones so common from India to the West of Europe?—[Tr.]

The best preserved skulls have been carefully examined by Professor Rütimeyer, of Bâsle, and have been recognised as belonging to the type called by Messrs. His and Rütimeyer the Type of Sion. The following is what Prof. Rütimeyer has written to me on this subject:—

'Allow me to tell you that the two skulls in question represent as clearly as possible the type which M. His and I in our 'Craniology of Switzerland' have called the Type of Sion. You know that this type is widely extended at the present day, although generally not in any great numbers in the whole of Switzerland, but that it was more prevalent in pre-Roman times, both in the tombs and also in the rare specimens of the kind found in the lake dwellings. I would especially mention the skull found by the late Col. Schwab in the lake dwelling of Nidau Steinberg, the skulls from the lake dwellings of Meilen, Robenhausen, and Wauwyl,[1] and, lastly—what gives a peculiar interest to the skulls found on *terra firma* at Auvernier—the two skulls discovered by Professor Desor in the bronze age lake dwelling near Auvernier. As the greater part of these skulls have been fully described in the notice of M. His, it is useless here to enter further into details either as to form or origin. It may suffice to say that the skulls which you have sent to me prove most decidedly that they belonged to the same race which constructed the abodes at the level of the water near Auvernier, and also built the tombs on *terra firma* in the neighbourhood. An important point in the ethnography of the prehistoric peoples of Switzerland is thus elucidated by this "find," and it is to be hoped that, guided as we now are by this discovery, it will not be long before the cemeteries belonging to other lake dwellings are brought to light.'

The specimens found together with these human remains are not as numerous as might have been expected, considering the number of skeletons. And yet they are very interesting, as they enable us to draw certain conclusions as to the relative age of the sepulchral vault under consideration.

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[1] I might also add those which have been lately found in the settlements of Lüscherz, Möringen, and Sutz, in the Lake of Bienne, many of which may be seen in our collection.

See on this subject, von Gross: 'Les habitations lacustres du Lac de Bienne,' page 12, and Professor H. Dor, 'Notiz über drei Schädel aus den schweizerischen Pfahlbauten.' Bern, 1873, Haller.

The following is the list of them (Plate LXXXIV.):—

1. Pieces of a boar's tusk, sharpened at one end and perforated at the other, in order to be suspended as parts of a necklace. Figs. 2 and 5.

2. A bear's tooth perforated, exactly like those found in the stone age lake dwellings. Fig. 3.

3. A wolf's tooth, also perforated for suspension. Fig. 4.

4. A little bone disc, 1⅛ inch in diameter, carefully polished on both sides, and perforated in the centre. Fig. 6.

5. A little celt[1] of noble serpentine, well made, and about 3¾ inches long, perforated with a small hole at the end opposite the cutting edge. Fig. 1.

6. A second celt, similar to the last, but smaller, and with the cutting edge blunted.

7. A little bronze ring. Fig. 12.

8. A bead of bronze (or of pure copper, if we may judge by the colour), exactly identical both in form and size with the spindle whorls of baked clay of the bronze period. It has evidently been used as a necklace ornament. Fig. 7.

9. A bronze pin (used either as a hairpin or a clasp for the clothes), about 6¼ inches long. At the top is a little flat head, and a little lower down the stem is thickened and perforated.[2] Fig. 11.

Some days after the vault had been cleared out, the workmen discovered, about six feet from it to the east, and at the same level as the tomb, a skeleton of a child in good preservation, lying buried in the simple earth, without being surrounded by flagstones. Very near it, however, there was a small slab placed in an upright position. Near this skeleton the following objects were found:—

10. A pair of small hammered bracelets, of an oval form, the larger diameter being 2⅛ inches and the smaller diameter rather more than 1½ inch. The internal surface is smooth, while the external surface is ornamented with raised lines, which look remarkably well. The ends of these bracelets

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[1] Last autumn I found in the lake dwelling of Sutz, in the lake of Bienne, several similar celts, but they have not hitherto been found in the other stations of this lake.

[2] I have never yet found in our lake dwellings of the bronze age any specimens like this, and I do not think they have been found in any other lake dwellings. This fact leads me to imagine that this pin had been imported (towards the end of the stone age) from some country where these pins were in use.

are simple and are without the flattened studs which are found on all the bracelets of the lake dwellings, and which are so characteristic.[1] Fig. 10.

11. A second pair of bracelets of the same size, but more massive than the last; they appear to me to have been cast. The internal surface is flat and smooth, while the outside has a median elevation, so that the section of the bracelet is in the form of a triangle. The ornamentation, which is exactly the same in both, consists of patterns skilfully engraved with the burin in chevrons and 'dog-tooth.' Fig. 9.

12. A red amber bead of middle size; the outside has become of a greyish tinge, from having been so long in the ground. Fig. 8.

13. A bronze pendant; a kind of stud formed of a disc about 1⅓ inch in diameter, surmounted by a little stem, rather conical, and ornamented with projecting rings. No similar specimen has hitherto been found in our lake dwellings. Fig. 13.

All these bronze objects were covered with the beautiful green patina characteristic of the bronze specimens found in the tumuli.

Lastly, I ought to mention the complete absence of fragments of pottery either of the stone or bronze age.

Now, if we endeavour from the facts above mentioned to ascertain the age of the tomb at Auvernier and the mode in which it was used, we may first mention that, on account of the small size of the vault, which was about 5 feet 1 inch long, the bodies could not have been placed there lengthwise, but they would have to be bent and doubled upon themselves, a mode of proceeding which has been already observed in other localities. As the sepulchral chamber contained twenty skeletons, we may easily imagine that they were not all placed there at once, but that the vault was opened as occasion required. And yet, as the single large slab forming the roof would be very difficult to lift, more especially as it was probably covered with a bed of earth from two to three feet thick, it seemed to me that possibly the bodies might have been slid into the vault through the opening made in the flagstone which closes the southern entrance. As the anterior chamber was not covered with slabs, and besides this no bones were found there, I imagine that the space left void between the two slabs formed a kind of corridor or entrance from the outside to the sepulchral chamber.

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[1] A similar bracelet was found in the tumulus of Favargettes in the Val de Ruz.

With respect to the age of this general tomb, if we glance at the specimens found with the skeletons, we may eliminate the stone age properly so called, and the '*bel âge du bronze.*' For if the tomb had been used during either one or the other of these great epochs, we should most assuredly have found in proximity to the skeletons the specimens charateristic of these two ages. Thus, with respect to the stone age, we should have found great stone celts, flint implements, objects of stag's horn, &c., and with respect to the '*bel âge du bronze,*' we might have expected to find swords, knives, and bracelets, like those found in the lake dwellings.

There remains to us then only the age of transition from that of stone to that of bronze,[1] that is, when stone was still in use, but when the settlers had begun by newly established commercial relations to receive from abroad (probably from Etruria) the earliest bronze ornaments.

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[1] In the Lake of Bienne there is a lake dwelling settlement (that at Gerofin or Gerlafingen) which goes back to a period exactly analogous to that of the tomb of Auvernier. We obtained there a number of objects of the stone age, and also, what is very remarkable, several objects in bronze, which are of a type entirely different from those of the lake dwellings of the '*bel âge du bronze.*'

THE LAKE DWELLINGS IN THE NEIGHBOURHOOD OF ESTAVAYER AND LA CRASAZ.

THE following account of researches made in this district by MM. Béat de Vevey and Henri Rey has been drawn up by M. A. Morlot.

Since the first discovery, in January 1854, of lake dwellings at Meilen in the Lake of Zürich, researches on this subject have been carried on in Switzerland to a great extent. The Lake of Bienne was examined and worked by M. Müller of Nidau, and by the late Colonel Schwab of Bienne—especially by the latter gentleman, who afterwards came into possession of M. Müller's collection. The Lake of Neuchâtel was explored towards its southern extremity, in the spring of 1854, by M. Louis Rochat, and his report is published in the present volume. About the same time (May 22, 1854) the pile buildings of Morges were discovered, and the greater part of the lake of Geneva was explored by the editor.

Colonel Schwab having called attention to the piles which are found in front of Estavayer, on the eastern bank of the Lake of Neuchâtel, MM. de Vevey and Rey, who live at Estavayer, set to work to explore first this locality and afterwards the neighbouring district. They used merely a pair of pincers fixed at the end of a long pole (see page 9), and as yet have only collected what specimens were visible on the surface of the lake bottom. These gentlemen have in this manner succeeded in obtaining a very interesting collection of specimens, the greater part of which were obtained amongst the piles of the bronze age in front of Estavayer. This locality will bear a comparison as to its bronze treasures with the Steinberg between Nidau and Bienne, and with the lake dwelling of Morges which has been examined by M. Forel. Colonel Schwab obtained at the Steinberg 500 bronze hairpins; but they were not all found on the surface, for he has trenched or excavated the bottom of the lake at this locality. At the lake dwelling of Morges forty bronze celts, thirteen bronze knives, and many other specimens were found, all on the surface; and

Estavayer up to the present time has produced the remarkable number of 128 bronze hairpins, and many other specimens of the settlers' industry, all lying on the surface of the lake bottom. At the present time we have to do chiefly with the objects found at Estavayer.

There are two pile works at Estavayer, remains of ancient lake dwellings; one near the shore, where nothing has been found but some stone and bone objects, without any specimens of bronze, and which therefore seems to date from the stone age; the other farther from the shore, which has yielded a quantity of bronze implements, and which we may therefore without hesitation attribute to the bronze age. It would seem as if the introduction of bronze having augmented the powers of action, the settlers had removed farther from the shore and established themselves in deeper water. This confirms my opinion that the chief end of these lake dwellings was for defence against their enemies.

LAKE DWELLING OF THE STONE AGE AT ESTAVAYER.

It measures probably 120 paces long by 60 paces broad, and runs parallel with the land. The space between the piles and the shore, which may be 45 paces long by 15 wide, was dry in the winter of 1857, but in general the bottom, which is pebbly, is covered with from two to four feet of water. A small stream, which runs through the town of Estavayer, here falls into the lake, and it may be that the alluvium brought down by it may have added to the shore and thus brought the mainland nearer to the lake dwelling; but as the specimens of ancient industry have been found on the surface of the lake bottom, this hypothesis is hardly admissible.

The following objects were found here:—

A dozen flat stones rounded, from 1½ to 2⅓ inches in diameter, perforated with a central hole; they may have been used as weights for the spindles used in manufacturing thread.

Two halves of two hammers of serpentine; one has a well-made hole for the reception of a handle.

Two arrow-heads of brown flint, apparently of a kind not found in Switzerland, Plate XCV. fig. 25. These specimens are pretty well worked; they are 1½ inch long.

A well-preserved hammer of stag's horn, Plate XCV. fig. 27. At one end it is rather rounded, as if to strike with, but at the other end it is a little hollowed out, as if it had formed a hafting for a stone celt or wedge; but on carefully examining this hollow it seems more probable that it results simply from the natural decay of the interior spongy part, and that a stone wedge was never intended to have been fixed in it. The hole for the handle is oval and well made; it is 1⅙ inch long and ¾ inch broad. The length of the whole specimen is 5 inches.

A stone hammer-hatchet, fig. 29, remarkable for the beauty of its workmanship, and bearing a strong resemblance to the excellent stone hatchets or celts found in Denmark, which are attributed to the bronze age. Implements of this form have not in general been considered as cutting instruments, for the edge in most cases is rounded, but rather as marks of distinction—as hatchets indicating command, and corresponding more or less with the baton of a marshal. The specimen, however, found at Estavayer has the edge sharpened; and a second characteristic, distinguishing it from the northern specimens, is that the hole for the handle is not round, but of an oval form, rather regularly made, about 1⅐ inch long and ¾ inch broad. The whole length of the specimen is 5¾ inches. On the upper part is a median ridge, projecting about a line or a line and a half, which has been formed by careful and regular work on a fixed grinding-stone or slab. The whole specimen is well worked and perfectly symmetrical, but one side of the end used for a hammer appears to have been notched and then again applied to the grinding-stone on this side, in order to flatten the fractured surface. The material is a dioritic rock, with particles of felspar; it is hard, is not scratched by the knife, and appears to have come from some other locality than Switzerland.

Four celts or regular hatchets, not perforated, made of common serpentine, probably from the erratic blocks found in the neighbourhood of Estavayer.

Rather a large tongue of flint, of a kind not found in Switzerland; it appears to have been shaped so as to form the point of a lance.

A flake also of foreign flint, which has been used as a saw.

LAKE DWELLING OF THE BRONZE AGE AT ESTAVAYER.

It is situated about 400 feet from the shore, and occupies an area of nearly 7,700 square feet. The water here is six or seven feet deep. There are a considerable number of piles, and this is the locality which has been most carefully examined by MM. Rey and de Vevey. Dr. Keller had previously announced that lake dwellings and antiquities had been found here; as, for instance, celts made of serpentine, flat grinding-stones, corn-crushers, pottery rings or '*torches*,' and spindle-whorls, both made of baked clay; also knives, sickles, bracelets, and hairpins, all of bronze. The following is a list of the bronze objects collected here by MM. Rey and de Vevey:—

Hairpins with great ornamental and spherical heads	36
Common hairpins	92
Knives	26
Bracelets	15
Sickles	5
Celt or hatchet	1
Fish-hook	1
Chisel	1
Rings of different kinds. Earrings (?)	27
Buttons	2
Blade of dagger	1
Arrow-head	1
Flattened wire coiled in a spiral form	6

It will be seen that this is a rich locality. It is especially remarkable for the number and beauty of its hairpins and knives, while celts are almost entirely wanting. We will now consider some of these specimens a little in detail.

The hairpins with spherical heads are of various sizes and lengths. The pin with the largest head, about 1¼ inch in diameter, is drawn Plate XCV. fig. 4. The head is hollow and has been cast, which is generally the case with all the bronze objects of this period. The shank goes through the head, and has been riveted or beaten to a small knob above; but some play has been allowed below, so that the shank can slide a little way and appear above the head, and the pin has been drawn in this position. This specimen weighs 2½ ounces troy, of which the head alone weighs 2 ounces. The pin is nearly 9 inches long.

The other hairpins with spherical heads, though often longer, have smaller heads, which are hardly one inch in diameter; they are ornamented in the same manner, but more simply. Three bands, each consisting of three or four even lines, bordered on each side by a dotted line, as in Fig. 4, go straight down from the concentric circles round one pole to those of the opposite pole. The three fields on the surface of the sphere thus separated by these bands, have each, in the centre, as it were, under the equator, a round hole 2¼ to 2¾ lines in diameter, surrounded by three concentric circles, bordered by an exterior dotted circle as in Fig. 4, only the poles thus set in a framework, as it were, of circles, are isolated, while in Fig. 4 they are joined alternately with the upper and lower poles by bands of lines, which in this specimen do not go from one pole to the other. In Fig. 4 the sphere is divided into quarters; four bands, each consisting of two or three lines, go from each pole till they meet the poles in the opposite hemisphere, as may be seen in the drawing. In the pins under consideration, of the ordinary size, like those drawn Plate XXXIV. fig. 5, from Nidau, the heads are also hollow, and the sides or walls of the sphere may probably be 1½ line thick. Hairpins of this kind are found elsewhere, but nowhere so abundantly as at Estavayer.

Besides the pins with spherical hollow heads, a great number of others have been found, as already mentioned. Some of the most interesting have been drawn Plate XCV. figs. 3, 5, 6, 7, and from 9 to 14.

Fig. 6 is rather curious. The pin is ornamented with chevrons for half its length; the head is massive, and the whole weight of the specimen is 2 ounces troy, though it is only 5½ inches long from the head to the point, which is quite perfect. To keep a pin of this description in the hair, it must have been used for tresses or very close plaits. This great variety of hairpins seems to indicate that in general the hair was richly developed. Bearing on this point, it may be well to remember that two hair (?) pins of bronze were found near Bern, cast from the same mould, weighing actually nearly 11 ounces, and of the astonishing length of nearly 34 inches.

The shank of the pin, drawn Fig. 9, is perforated; the hole has been represented in profile in the figure. No remark need be made as to the other specimens drawn.

The pins found at Estavayer vary considerably in length; that of the five longest is from 10 inches to 10¾ inches; that of the five next in size is from 7¾ inches to 9 inches. The three shortest pins are only 2¾ to 3 inches long; a considerable number are about 3½ inches in length.

As before mentioned, Estavayer is remarkable for the number and beauty of its bronze knives, drawn Plate XCVI. figs. 2, 3, and 7 to 15. They indicate, in fact, such an amount of luxury in this class of implements as can be found nowhere else in Switzerland, thus almost certainly showing that they were industrial products which belonged rather to the end than to the beginning of the bronze age; for knives with a longitudinal cutting edge, like those of which we are speaking, appear only gradually to have replaced the hatchet-knives or celts with a transverse edge, which were, in fact, simply the reproduction in bronze of the instruments so commonly in use in the stone age.

Many of these knives are ornamented on both sides, and also on the back, as is shown by the drawings. Others are not ornamented, but still have a very elegant form like that drawn Fig. 2; lastly, others, like Fig. 3, are very coarsely manufactured.

The backs of many of these knives have been thickened at the sides, to give more strength to the instrument, but still the metal was husbanded and the edge was left thinner, like that of our modern razors. It will be seen that transverse sections are given of Figs. 10 and 14. The ornaments of these knives are in good taste, and in the style characteristic of the bronze age, with the exception perhaps of the specimen drawn Fig. 14, which has something strange about it. Fig. 15 shows the ornaments on the back of this knife.

Many of these knives have been very decidedly and regularly in use, such as Figs. 10 and 2. They have evidently been used to cut soft materials, like flesh, skins, or tissues. Fig. 7 has been used especially towards the end which is sharp up to the angle formed by the back. The two largest specimens, Figs. 8 and 9, are both 9 inches in length.

Fig. 4 appears to be the blade of a dagger, but it has been inserted into the handle rather differently from the mode usually seen in bronze specimens. Plate XCV. fig. 1 is a little bronze chisel. Fig. 26 is an arrow-head of bronze with a crack or flaw on the side, as may be seen in the drawing;[1] a little round hole runs from one side of the socket to the other, to enable it to be riveted to the wood of the arrow. Fig. 28 is a bronze hatchet of the kind improperly called a celt. The socket being round would have allowed the hatchet to turn upon its handle, but to prevent this the moulder has arranged four longitudinal ribs running all along the inside of the socket, and about half a line high. The socket is 2¾ inches deep; the whole length of the specimen is 4½ inches.

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[1] As this flaw is in the shape of a pretty regular crescent, many persons have thought that, instead of a flaw, it was an intentional groove or gash for the insertion of poison. The strongest vegetable poison of Switzerland would be obtained from the Euphorbiaceous plants, and this would not be powerful enough to cause death. But it is not impossible that the settlers may have obtained more active poisons from their commerce with the East.

The cutting edge, which is a little curved, is 1½ inch long. As already mentioned, it is the only hatchet which has been found in this locality, while forty have been dredged up at Morges; but they are quite of another sort, like those called 'Paalstab' in the north, and which have been fastened to a cleft handle by means of four side flanges.

Plate XCV. fig. 31. A bronze sickle of the usual form, but very large. The diameter of the semicircle formed by the outside is 6¾ inches. The transverse section of the blade is represented at *a*, below the figure.

Figs. 19 and 20. Different views of a little implement of bronze, which, though thin, has still been cast: it is in shape nearly like a button, and has doubtless been used as an ornament for some woven fabric or leather-work.

Fig. 24. A fish-hook of bronze, like those found by Colonel Schwab at the Steinberg of Nidau.

Figs. 16, 17, 21, and 23, are bracelets. Fig. 21 is massive, and has the opening oval; its greatest internal diameter is 2 inches. Fig. 16 is thin; it is only about half a line in thickness. Fig. 17 is more massive, the greatest thickness of its transverse semicircular section being one-fifth of an inch. This specimen is too large to have been worn on the forearm, for the opening, which is of an oval form, is 3½ inches across where the diameter is the largest. Fig. 23, of which the section is given below, is rather oval, and the diameter where greatest is little more than 1½ inch. If it was intended for a bracelet, it must have been that of a child. The ornaments on all these bracelets are of the style usual on specimens of this nature in the bronze age.

Fig. 18. A bronze ring which is rather thin: the opening is oval; the greatest diameter measures ¾ inch.

Figs. 2 and 22. Bronze spirals. Fig. 2 is of bronze wire; the section is semicircular, and is shown on one side. Fig. 22 is of very thin bronze plate, not thicker than a quarter of a line.[1]

Plate XCVI. fig. 1. A specimen of rather fine pottery, with the surface blackened and polished, and having the appearance of the cover of some vessel. On examining the surface of the inside, which is in very good preservation, it will be seen that, though regularly circular, this vessel has not been made with the wheel. The edge appears to have been ornamented all round with leaf-tin, some portions of which still remain. From this edge or border four thin bands of ornamented tin run on the outside from four different points, carried nearly to the centre of the specimen. One of these bands is still in good preservation; it is simply laid or pressed upon the vessel, and is not riveted: the remaining bands have only left their traces. The handle is in the shape of a semicircle at the top of the vessel; it also is ornamented with tinfoil. The metal has been examined by Professor de Fellenberg, and proves to be pure tin without any mixture of lead. The diameter of the specimen is 5½ inches; the height, including that of the handle, is 2 inches; the thickness of the sides or walls is about one line.

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[1] My friend, the Rev. C. W. King, in a paper yet unpublished, but which is elsewhere referred to, speaking of the armour of the Gauls, quotes Diodorus, who says that 'their shields are as tall as the men, and painted over in a peculiar fashion : some of them have figures of animals in relief of bronze, not merely for ornament but also for defence, and very well wrought.' On this passage Mr. King remarks: 'The flat spirals of considerable diameter in stout bronze wire so often found on the Continent, were doubtless some of the ornaments fixed upon these shields. Their construction would afford great additional strength with very slight increase of weight to the substructure of board and hide.'—[Tr.]

Plate XCV. fig. 15 shows the section of this cover.

Another specimen, no less interesting, is a little bar of tin made into a prismatic form by the hammer. It is 7⅓ inches long; its greatest thickness is ⅕ inch, and it weighs half an ounce. The colour of the metal and its great ductility show that it consists of pure tin, thus confirming the assay made by M. de Fellenberg, who did not find in it a trace either of lead, zinc, copper, or iron.

We cannot venture to conclude, from the presence of this little bar. of tin, that the metal was employed on the spot to make bronze. The cover ornamented with tin, and which has been already described, proves that this metal was employed in a pure state to ornament different objects, as is still the case in some countries.

Lastly, Fig. 30, Plate XCV. represents a celt of serpentine found amongst the piles of the bronze age. It is a knife-hatchet with the cutting edge curved, and a little oblique. It fits the hand very well, and evidently was not intended to have been fixed in a handle. It was probably made from the serpentine of some erratic block found in the neighbourhood, but it may possibly also be of some stone not found in Switzerland. It is schistose and very hard; it cannot be scratched with the knife.

Since the appearance of the first edition of this work a number of antiquities have been found at Estavayer, several of which are drawn on the following plates:—

Plate XLIV. fig. 6. Bone ornament.

Plate XLV. fig. 3. Horse's bit of stag's horn.

Plate XLVII. fig. 6. Bronze arrow-head.

Plate XLVII. fig. 8. Implement of bronze, use unknown.

Plate LXI. fig. 4. Bronze pin.

Plate LXIV. fig. 1. Bronze armilla.

Plate LXXI. fig. 5. Bronze implement, use unknown. An implement precisely similar to this was discovered several years ago at Chevroux, see Plate XXII. fig. 21.

Plate LXXIII. fig. 7. Several *bronze* rings strung on a *tin* ring.

Plate LXXVII. fig. 9 and fig. 9A. Earthenware vessel with a spout at the side.

Full half a league north-west of Estavayer, near the village of Autavaux and La Corbière, there is a place called La Crasaz, where there are two lake dwellings in the lake, as at Estavayer; the one nearer the shore, of the stone age; and the other farther in the lake, of the bronze age. These localities, as at Estavayer, are situated near where a stream runs into the lake, and this, in fact, is in general one of the conditions which seem to have determined the choice of the situation of lake dwellings. These piles at La Crasaz are known to the fishermen, and, as well as those of Estavayer, are called by them Les Teneviëres.

LAKE DWELLINGS OF THE STONE AGE AT LA CRASAZ.

When the water is low, the lake here is only from one to five feet deep, and the piles are then very near the shore. The following are the specimens which have been found here.

Three tongues or flakes of a clear brown flint of a kind not known in Switzerland. The largest, Plate XCVI. fig. 6, is 7½ inches long, being, in fact, the largest which has been found in Switzerland. Similar ones, but smaller, have been found at Concise. The specimen, as will be seen by the figure, is worked very regularly on one side, while the other is formed simply by a tolerably even fractured surface slightly convex in the direction of the length, and produced by the blow which detached it from the original block of flint. The section is nearly semicircular. This flake can hardly have been used as a lance-point, for then it would have been worked on both sides, and more especially some attempt would have been made to do away with the concavity of the posterior face towards the two ends. It is too thick to have served for a saw. It may possibly have been used for hollowing wood or scraping skins: some use of this nature appears at least to be indicated by the fact that the lower face has been left perfectly smooth and intact.

A celt of serpentine, hafted in a piece of stag's horn, made with a mortise so as to have had in its turn a wooden handle like those which have been found elsewhere in Switzerland, and especially at Concise. A wedge or celt of serpentine not hafted. The half of a celt or hatchet made of serpentine very neatly pierced with a hole for the handle. Plate XCVI. fig. 5 is a hatchet of stag's horn. This specimen is in good preservation and is very interesting. At the larger end a hole has been made through it for a handle; this hole is rectangular, with the angles rounded, and is 1$\frac{1}{5}$ inch long and 1 inch wide. At the other end, the horn, as shown in the figure, has been left on one side in its natural state, while on the other it has been cut off obliquely, so as to produce rather an irregular cutting edge, but placed so that it evidently formed part of the plan of the instrument which has been actually used, as may be seen by the polish of the horn in this part. It is clear that this instrument has never had the addition of a stone celt or any other cutting material. It may be well to mention this, for at Concise, where similar specimens have been found, the workmen, to make them more interesting, have fitted stone celts into them, and thus disfigured them. It is very probable that this specimen has been used as an agricultural hoe. The length is 9 inches.

Two pointed tools or awls of bone. Several small disks, probably spindle-whorls. A fragment of pottery, tolerably fine and ornamented.

Lastly, there has been found here a bronze hairpin, Plate XCV. fig. 8, with a little bronze ring passing through the head; but as the bridge or stage connecting the shore with the lake dwelling farther off in the lake would doubtless pass over that now under consideration, this pin may probably belong to the age of the more distant settlement.

LAKE DWELLING OF THE BRONZE AGE AT LA CRASAZ.

It has as yet been little worked, nevertheless a few things have been found there, such as two good bronze hairpins, two little bronze rings, and an earthenware vessel very neatly finished, as if it had been made by the wheel.

MM. Rey and de Vevey have taken the trouble to extract some of the piles from this spot in order to examine them; they are of oak, and the part covered with mud was in a very good state of preservation; that part which projected above the lake bottom is very much worn away, as is the case in other localities. These piles are about 9¾ inches in diameter. The part buried in the mud, or that which had been driven into the lake bottom, was about 4 feet 11 inches or more in length. The whole of this portion has in general been sloped into a point in a very regular manner; the blows of the celt or hatchet followed each other in the same direction, producing facets running nearly all along the point almost exactly in the same planes. The workmen evidently were clever carpenters. The facets are not more than 1½ inch wide, which is exactly the width of the bronze celt found at Estavayer, Plate XCV. fig. 28. The workmanship of the piles of the lake dwelling at Moosseedorf of the stone age is altogether different and much rougher, for every blow of the hatchet is on a different plane, and there is no appearance of any regular facets. The piles of the bronze age at La Crasaz are so regularly worked that one would imagine they had been made, not by the bronze celt or hatchet, but by a strong steel tool used with both hands. The difference of the hatchet-work on the points of the piles of the stone and the bronze age is as great as that between the point of a pencil cut by a child, and one cut by a grown person with a firm hand and accustomed to the work.

At the south-west of Estavayer, near Font, MM. Rey and de Vevey have also found indications of antiquities on the shore of the lake. We will at present only just mention the 'find' of bronze hairpins in the natural grottoes in the escarpments of the 'molasse' of this district. As MM. Rey and de Vevey are continuing their explorations, we may hope before long to have a supplement to the present notice, with more ample information as to the antiquities of the neighbourhood of Font.

It may be well to append to the above report of MM. de Vevey and Rey a notice of some antiquities found at Estavayer, and now in the collection of the late Colonel Schwab of Bienne.

Plate XCVII. fig. 1 represents a bar of tin nearly 6 inches long.

Fig. 2. A bronze arrow-head.

Fig. 3. A bronze saw.

Fig. 4. The ferrule of a stick (if this word can be applied to an implement made of bronze).

Fig. 5. A thin armlet of bronze.

Fig. 6. Ornament made of thin bronze plate.

Figs. 7 and 8. Two views of a disk cut from the horn of the elk.

Figs. 9 and 10. Two views of a bronze nail with a kind of socket at the top.

Fig. 11. Bronze boss.

Figs. 12 and 13. Stones of the kind commonly called 'sling-stones.'

Plate XCI. figs. 1, 2, 3, 4. Fragments of pottery ornamented with narrow strips of tin, like the larger vessel of a similar kind found at Cortaillod.

Some jet rings and a little cramp and plate of gold were found here.

Plate XXXIX. fig. 10. Neck of a vase 3 inches wide, made of black, well purified clay, without grains of stone; the sides are only 1½ line thick. The mouth on both the inside and outside edge is set with a narrow strip of tin as thin as paper. These two strips, which are about 1½ line apart, are bound together in four places by small tin bands. This vessel appears to have been made by the same workman as the cover drawn Plate XCVI. fig. 1, or at any rate to have come out of the same workshop.

Plate XXXIX. fig. 11. Blunt hatchet of serpentine with a haft-hole. Some remarks as to the mode in which these perforations were made in early times will be found at page 78 of Sir W. Wilde's 'Catalogue of Irish Antiquities'; in the earliest ages he thinks they were made by turning round a hard stone, and in after times by a metallic drill.

Plate XXII. fig. 29 is a well-made arrow-head of bronze.

NOTES ON THE LAKE DWELLINGS IN THE NEIGHBOURHOOD OF YVERDON.[1]

By M. Louis Rochat.

Remains of lake dwellings have been found in the neighbourhood of Yverdon, at Concise, Corcelettes, Les Uttins, Clendy, and Cheseaux; that is to say, that except in front of Grandson, where the water suddenly becomes very deep, and at Yverdon, which is built on recent alluvium, each of our modern villages has a corresponding lake dwelling in front at a short distance, see the small map, Plate CII. fig. 1. If the marshes of the Orbe were trenched, very probably piles would be found opposite to each group of modern dwellings.

The piles of Clendy and Cheseaux, though at a short distance from the town, have not been investigated.

Les Uttins are situated about twenty minutes' walk from Yverdon, at the eastern foot of Mont Chamblon. Piles like those in the lake are found there in the turf-pits. Springs of excellent water rise from the foot of the hill opposite to each of them. The following section was pointed out to me in one of these turf-pits by M. Ch. Simond, Plate CII. fig. 2. The upper bed of vegetable mould is about 17 inches thick; about 4 feet 4 inches below were two great trunks of trees lying down with their roots; and about 6 inches below this, and consequently about 6 feet 3 inches from the surface of the soil, the heads of piles begin to appear, worn to a point in the same manner as they appear in the lake; these piles go through first about 18 inches of peat, then about a foot of fine clay, and go still 18 inches deeper in a bed of very hard peat, underlying the clay. This lower bed of peat is about 3 feet thick.

Two groups of piles may be seen at Corcelettes. The first, to the east of the hamlet, is at least 690 feet long and 426 broad. The area may be estimated at 25,000 square yards. The lines and groups of piles are remarkably regular. When the water is low, they are at no great distance from the bank. The second group of piles is to the west of Corcelettes, in front of the property of M. de Bossey. It is a rectangular enclosure, called Port à la Reine, about 32 feet long by nearly 20 feet broad. The sides or walls, about 3 feet thick, are in perfect preservation, and are formed of three rows of piles with the spaces filled in with pebbles; they might easily have been taken for the foundations of a tower. The interior, which is full of mud, has not been trenched.

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[1] This paper gives so much information, and is of so much importance, that it is useless to attempt to abridge it; we have therefore given it entire.—[Tr.]

At the entrance of the little bay, which before the construction of the railway was used as the port of Concise, Plate CII. fig. 3, a hillock or shallow is visible at the bottom of the lake, about 260 feet from the shore, called by the inhabitants La Tenivière. All round La Tenivière the dredge only brought up great round pebbles mixed with mud, but when it was set to work on the shallow, the boats were filled with broken stones of various sizes, mixed with piles and other remains of human industry. These stones, which evidently had been artificially broken and brought here, make La Tenivière analogous to the Steinberg or hillock of stones at Nidau. This Concise Steinberg is nearly in the shape of a semicircle, with the convex parts looking south and turned towards the lake. It is 459 feet long from east to west, and about 255 feet broad from north to south. When the lake is about 6½ or 7 feet below the highest level, the top of La Tenivière is only about 11 inches under water. Around this point the depth augments rather rapidly; at the foot of the southern slope it is 6 feet 10 inches, but on the northern side only 4 feet.

About one-fifth of La Tenivière has been examined by the dredge or scraper. There is hardly any accumulation of sand, so that some remains may be noticed on the surface. The piles may be seen in the trenches, scooped out by the dredge, and penetrate the bottom from 5 to 6 feet, but it is useless to look for any remains of human industry so deep; nothing made by man is found below 10 or 12 inches under the surface of the bed of the lake.

The locality of the piles at Cheseaux and Clendy is, like that at Concise, a raised hillock formed of broken stones. At Corcelettes the stones are not found over the whole surface. In more than ten places, where fragments of pottery were found on the surface, I was able to thrust in a pole nearly five feet, without finding anything but sand. At Les Uttins there is no trace of a Steinberg under the peat.

At Concise, no characteristic fact has enabled me to ascertain with certainty why all these broken stones have been brought here: but perhaps when more carefully examined their arrangement with respect to the other industrial remains may explain their use. They probably are now found exactly in the same position as when they were first thrown down, for the force of the waves goes very little below the surface. Thus at Corcelettes, at a depth of about 5 feet, I dredged up, very near to each other, two fragments of the same vessel, the edges of which, when cleared a little from the mud which covered them, fitted exactly; the angles were sharp, not having been rolled about by the waves.

Most of the stones of the Concise Steinberg doubtless served as a kind of breakwater, not against the violence of the waves, but to consolidate the ground around the piles. If they had been accumulated on the edges of the platform to serve as a defence, as some people have imagined, they would still form around the piled area a border of stones which I believe has never been noticed. An opinion has also been expressed that they were laid upon the platform to consolidate it; but this apparently would have been very useless.

The beams or planks forming the platform for the huts are not met with in any of the localities cited. The peat-cutters at Les Uttins have often spoken to me about horizontal beams with mortises; they even assert that there was a wooden road there, across the marsh, but nothing of the kind is now visible.

Neither have we found any of those fragments of clay, half-baked (by the conflagration?), which were used to cover the wickerwork or walls of the huts.

The piles we found were of oak. M. Simond tells me that he got from his turf-pit one made of a cherry-tree with its bark on, and another of ash; but I have not seen them. We also found a yew-branch cut with a stone celt, and two pieces of fir-wood, and this is all we learn from our collections as to the trees of this period. But, on the other hand, numerous specimens of instruments were found which were used for fashioning the wood, and doubtless also for other purposes.

At Concise hundreds of haftings for the stone hatchets and chisels have been found, made of stag's horn. I have drawn, Plate CII. figs. 4, 5, 6, 7, 8, some forms which are new, but none of the pieces in which these haftings were fixed have been found here.

The stone celts or hatchets have been met with in great numbers, and we possess more than eighty. Some were still firmly fixed in their haftings by means of fibres of bark. When they were sharpened on the whetstones or sandstones they were not taken out of their handles, for when the stone or cutting portion is rather short, the bevelling is continued on the edge of the handle.

The observations made at Meilen as to the shape, the size, and the original material of these instruments, might be repeated at Concise. Most of them are of serpentine from the Valais, some of siliceous sandstone (lidyte?), two of transparent jade (nephrite). A large number are merely sharpened pebbles; some few have been made as if by the picks of our masons, and on many of them may be noticed traces of the saw as clearly as those produced by our modern tools. It seems very difficult to imagine how results like these can have been obtained without metals.

There is nothing particularly new in the forms or dimensions. I had the knife, Plate CII. fig. 9, figured because of the obliquity of its cutting edge; and the chisel, Plate CII. fig. 10, because it is sharpened at both ends.

One single bronze celt was dredged up at Corcelettes by the late Colonel Schwab.

What served for saws were pieces of flint, sometimes seven inches long, serrated either on one or both sides, like that from Meilen, drawn Plate III. fig. 3; some, which are very thin, make excellent sawing tools. Those which terminate in a point have probably been used as awls; some of the others to enlarge the holes when made, like that drawn Plate III. fig. 2. We have also found flakes wider and shorter, with a semicircular serrated edge, Plate CII. fig. 11, which appear to have been hafted saws, like that found at Moosseedorf by Dr. Uhlmann, drawn Plate V. fig. 5.

The piece of stag's horn, drawn Plate CII. fig. 13, is like an unfinished handle, but the great end looks battered, as if it had been used as a hammer.

Our best hatchet-hammers of stag's horn are drawn Plate CII. figs. 12, 14, 15. We have also fragments of others, more carefully worked, and of a better form. None have been found with the hatchet or celt still fixed at one end, in the original form. The specimen drawn Plate CII. fig. 16 is cut with a sharp bevel at the end, where it seems as if a hatchet should be fixed.

The hatchet-hammers of stone are rarer than those of stag's horn; they are like those previously described by Dr. Keller. The finest fragment of a tool of this kind is drawn Plate CIII. fig. 1; it has two grooves on the side, its form is elegant, and it is beautifully polished.

Plate CIII. fig. 2 is a perfect hammer-hatchet in the collection of M. Clément of St. Aubin.

Plate CIII. fig. 3 is an irregularly-shaped pebble, pierced with a great hole; if intended for a hammer, it must have been a very inconvenient one.

The nature of the antiquities found throws back the date of the pileworks of Concise, Corcelettes, and Les Uttins to a very early age, and shows that they existed for a lengthened period. In the two first localities, bronze objects of excellent taste and workmanship, sawn stone celts, hatchet-hammers perforated with the drill, and earthenware vessels thin and well ornamented, are found together with sharpened pebbles and the coarsest kind of pottery made by the hand alone. At Les Uttins a bronze bracelet has been obtained from the same peat-digging in which two stone celts had previously been found.

But besides the nature of the objects, the locality of the pileworks at Les Uttins may give us an idea of their great antiquity. A vast plain formed of alluvium extends between them and the lake; one of them is 1,850 yards, and the other 2,200 from the present bank, and the whole of this plain is composed of matter brought down by a little torrent called La Brine.

This marsh has been carefully surveyed, with a view to its being drained, and the engineers who have examined it admit that a very long time would be required to form a similar deposit; but, taking the local circumstances into account, they do not think it can be determined, even approximately, when the lake washed the foot of Mont Chamblon, so as to allow the inhabitants to erect their curious structures in that locality.

The handle of the beautiful bronze sword found at Concise in 1832, as well as those which I have seen in the collections of M. Troyon and Colonel Schwab, show that the inhabitants of our lake dwellings had smaller hands than those of our present race of men; but the human remains in our possession are not sufficient to indicate any other physical character. Amongst an extraordinary number of bones, we have only found one fragment of an adult human skull, the frontal bone of a child, and a lower jaw with the second great molar tooth springing up. There are no marks of the knife on any of the remains, and from the small number of them we may conclude that the people were not cannibals. The products of their industry seem to me to indicate a slow but constant progress in the art of employing the resources of the country; and this progress places them, on the score of intelligence, far above the savages of the present day.

We have met with no flax, like that so common at Wangen and Robenhausen: the only similar material was a little parcel of bark filaments, very finely divided, which may have been 'bast.' The little roundels, or circular objects like counters, perforated in the centre, are generally considered as spindle-whorls; two have been found made of stag's horn, two of pottery, two of the stone called 'molasse,' and thirteen of limestone. In two of those of the last-named material, the hole has been pierced with a bad tool, probably of flint; in one it has been made by a point or pick, in all the others by the drill or lathe. I will venture on a remark or two as to the use generally assigned to them. Those made of stag's horn are very light for the purpose, and those of pottery very fragile, while the holes in those made of stone are often very eccentric, Plate CIII. figs. 4, 5; they are of all varieties of size, and sometimes very small indeed. One belonging to M. Clément is only a line in diameter. If a twig or short rod had to be fixed in the hole, how could it be held firmly in the disc, Plate CIII. fig. 6, and in most of those where the hole is wider towards the outside, and of which the section takes the form of a double cone, one on each face? I may remark, lastly, that we have found an oval stone with *two* perforations, which I had put aside amongst the things probably forged; but when I found that Dr. Keller had also discovered a similar one, I replaced it, following the series of those with a single hole.

The weaver, the dyer, the tanner, and the tailor have left us nothing characteristic at Concise; we have found neither the material like matting of Wangen nor the coarse cloth like that of the cloak found in Denmark, and said to belong to the bronze age.

We have found no bronze needles similar to those of the present day, but on the bone point, Plate CIII. fig. 10, certain notches with rounded angles may be observed, like those produced by the friction of a thread. The pig's incisor, Plate CIII. fig. 11, the root of which has been split and sharpened, may probably have been used to perforate cloth or leather. It would be interesting to ascertain the use of the stiletto of bone pierced at the point by a rectangular hole, drawn Plate CIII. fig. 35.[1]

If the clothing of the women of that period at all harmonised with the objects used for ornament, it was deficient neither in taste nor variety. Concise has added eight or nine bronze hairpins to hundreds which I have already. From Corcellettes we have obtained a bronze hollow bracelet, but there is nothing in it particularly remarkable. The collection of M. Troyon contains a bronze hairpin, with a ring for the hair-band to go through; our specimens in stag's horn, drawn Plate CIII. figs. 20, 21, have doubtless formed the model for it.[2] Fig. 22 is also a model in bone of the ordinary bronze pins. Fig. 23 represents a pin rather short and slender, if used for the hair.

Fig. 24 is the drawing of the fragment of a bone pin; the head is flattened and is pierced with two holes. Two small boxes made of stag's horn have been found at Concise. They are drawn Plate XLII. figs. 16 and 17.

It is a curious fact that the bronze ornaments are only improved copies of the analogous objects in bone. I have heard the opinion expressed that the colonists of the age of stone were different from those of the age of bronze, and that iron was suddenly introduced by new and more civilised tribes, whose superiority arose from a knowledge of this metal. The population of the age of bronze are said to have been stronger than that of the age of stone—even the very dogs were larger. These sudden transformations of rural populations have something very singular about them. Nothing similar appears in historic times. The reproduction in bronze of the coarse bone ornaments of previous ages shows that the people of these two periods had the same tastes and the same customs. Our collection does not possess a sufficient number of specimens for comparison; but the museum of Colonel Schwab contains many iron implements, which have been forged with difficulty after the model of analogous specimens cast in bronze. The new metals appear to have been gradually substituted for the material previously in use, without any change in the mass of the population, except by a gradual improvement. Things take this course at the present day.

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[1] May this not have answered the purpose of a coarse needle? An instrument almost exactly similar in form, but made of iron, and often with a wooden handle, is used by our modern wine merchants, and in fact by all those who have to pack *coarse* hampers. A piece of strong twine is passed through the eye or hole, so that only a few inches hang on one side, and the sharp end of the instrument, which is very strong, is forced by means of the handle through the edges of both the hamper and the cover; of course it carries the string with it, which is then drawn out of the eye and pulled tight; the instrument is then drawn back, and the process is repeated. This may seem a slow operation, but it is very effective in the case of rough coarse hampers; a packing-needle of moderate size can hardly be forced through the plat-work of a strong hamper.—[Tr.]

[2] Probably the specimen drawn Plate XCIV. fig. 22, from Concise, is of a similar kind. It is a kind of curved pin with a perforated projection on the convex side; a string or cord has apparently been passed through the hole.

The bear's teeth perforated at the extremity of the root, like that drawn Plate III. fig. 6, have been frequently found at Concise. One, drawn Plate CIII. fig. 37, has a circular groove all round instead of a hole. We have also whole boar's tusks with a round hole at the thick end on one side, but it does not go through to the other, Plate CIV. fig. 15. There may be a question as to whether these perforated teeth were used as ornaments, but the two little specimens, drawn Plate CII. fig. 20, and Plate CIII. fig. 19, most probably have been the beads of a necklace. One is only a bit of horn roughly rounded and perforated, the other is a little bone cylinder, cut away in the middle, and perforated lengthwise at the two extremities; the workmanship is so good that it would do no discredit to a modern necklace. Plate CII. fig. 19 may also have been a necklace-bead. The rectangular plate, drawn Plate CIII. fig. 25, made of the enamel of a boar's tusk, and with a little hole at each end, may probably have been riveted on to a strap; the oval plate of the same material, Plate CIII. fig. 39, has the holes well polished and splayed on each side; a cord has evidently passed through them.

Fig. 36, Plate CIII. represents the fragment of a jet bracelet, small but well executed.

The bronze wire, Plate CII. fig. 18, with the two ends curved into a close spiral, is a curious ornament of the same design as several beautiful specimens in the museum of Copenhagen.

Lastly, we may mention a real bronze button, Plate CIV. fig. 19, exactly like our large modern buttons: its shank is well soldered, but not strong, and the disk is very thin. It is perhaps rather an ornament than an actual fastening.

After what is superfluous let us come to what is indispensable. The indigenous fruits were made use of by the settlers for food. We find hazel-nuts, raspberries, beech-nuts, crabs, and stones either of the sloe or the cherry.[1] At Concise the excavation was made so rapidly, that none of the carbonised wheat could be found, like that of Wangen; neither have we met with bronze sickles, like those so common in the pile settlements of Estavayer and Cortaillod; but probably these evidences that agriculture was then carried on will not be long wanting, as we are already in possession of the remains of the most important domestic animals.

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[1] I am reminded by an antiquarian friend that, according to Pliny, the cherry-tree was first introduced into Italy by Lucullus from Pontus. Plin., Nat. Hist. ii. 25. Pliny states that in 120 years it had spread even beyond the ocean into Britain. This, however, can only apply to the sweet cherry.—[Tr.]

M. Leuthold, veterinary surgeon at Cossonay, thinks he can distinguish three species of oxen: one, a small kind, of the size of the cattle of Savoy and the Valais; another larger species; and lastly, a third variety, judging from a tibia, one of the main metacarpal bones, and a rudimentary horn, which appear from their size to be of a different species from our domestic oxen.[1]

We have met with perfect skulls of the goat and the sheep. Small tusked pigs appear to have been reared in great numbers.

The lake-settlers evidently did not neglect game; and wild animals formed their chief resource, and furnished them abundantly with flesh, skins, and furs. We have well-characterised remains of the roebuck and the elk, superb stags' horns, and a skull of the wild boar; very large tusks of this animal are by no means rare.

We have two skulls of the dog; half the lower jaw of the beaver, and two halves of that of the bear. We think that we have also found the skulls of the polecat, the marten, the weasel, and the badger. Lastly, M. Morlot has drawn my attention to the marks of the teeth of rats and mice on several pieces of stag's horn.

The determination of the bones is very difficult; what we have just stated ought to be verified by competent persons, who will doubtless find some new species amongst the bones and the teeth which we could not assign to any particular animal.

The weapons of the chase and of war, together with female ornaments, form the most important specimens left us of the industry of these people.

Two bronze swords were dredged up at Concise in 1832, but only one is now in existence; it is deposited in the museum of Neuchâtel, and drawn Plate CII. fig. 17: the material of the blade approaches to bell-metal in colour and hardness; the alloy used for the handle is rather red, and seems to contain less tin.

We have not met with any bronze lance- or arrow-heads, but our flint arrow-heads are remarkable for the beauty of their workmanship, and if they were made on the spot, they show that our lake-settlers were fully able to produce good lances and daggers like the specimens from the north shown to me by M. Morlot, the want of the raw material in our country being the only difficulty. Three of these arrow-heads are of new forms, and are drawn Plate CIII. figs. 7, 8, 9; the rest are similar to what have been found in other settlements. The use of the great lozenge-shaped flint, drawn Plate CIV. fig. 16, is unknown to me.

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[1] Professor Rütimeyer has examined these three bones, and believes them to be those of the common ox.

The bone lance, Plate CIII. fig. 18, and the arrow-heads, figs. 12, 13, 14, 15, 16, 17, belong chiefly to Dr. Clément of St. Aubin; they are remarkable for the beauty of their form and workmanship. If one of our modern workmen with his steel tools could make them quicker, he would find it difficult to make them better.

In 1832, the fishermen who had found the bronze sword also got up a boat which was simply a hollowed tree. This and the two harpoons of stag's horn, drawn Plate CIII. figs. 26, 27, form the whole of the fishing gear found at Concise; the bronze fish-hooks, both single and double, now in our collection were presented to us by the late Colonel Schwab.

I have unfortunately been unable to ascertain anything as to the fishes which were made use of in the lacustrine age; it would, however, be interesting to know whether the great changes which our lakes must have undergone by alluvium have altered the nature of any species, and thus brought about a corresponding change in the aquatic fauna.

A great number of the stones used as corn-crushers have been buried in the embankments of the railway. We found them of different sizes, very like those of Meilen; but I have in vain searched for the pebbles, as large as one's two fists, with a little hollow on two opposite sides. The late Colonel Schwab, who had a large number in his collection, gave us some, both from Estavayer and from Nidau. I have not found any of the flat stones which formed the hearths; but ashes and charcoal are by no means rare, and at Corcelettes in particular are met with in considerable quantities.

We have found fifteen of the great clay rings, like those drawn Plate XXXVIII. fig. 14, from Nidau. One is from Concise; the other from Corcelettes, where they are found in abundance: they were used as supports for the cooking vessels when placed in the fire. The material of which these rings or 'torches' consist can only be explained by the fact of their having been used in the fire. It was in the hearth-fires that they became half-baked. The central part, still black and friable, has been little more than dried; the exterior is red like any other well-burnt clay; but the layer of red colour, which is thick above, and on the outside, where the fire was the strongest, is very thin inside the ring, and especially so below. Plate CIV. fig. 1.

The cooking vessels are rounded or narrow below, and often have the sides splayed or widened, so as to expose a greater surface to the heat. One of them, Plate CIV. fig. 5, is not circular; it might be taken for a pan for frying fish. Plate CIV. fig. 4, is the drawing of a great spoon of baked clay with the handle broken. We have quite a series of large porringers, dishes, plates, cups, and drinking vessels. The most remarkable in form and ornamentation are drawn Plate CIV. figs. 2, 3, 6, 7, 8, 9, 11, and 12. Three, four, or more varieties may be noticed in the clay used for these vessels. None of it has been washed, and in every instance it contains little siliceous pebbles. All the vessels were made of the same clay, the difference arising from its having been taken from different depths. In the pits where the potters dig their clay the quality varies according to the depth; the small siliceous gravel is more abundant near the surface.

Clay containing siliceous grains, however, was not used specially for the vessels adapted for cooking; some undoubted pipkins are of fine clay, while others of a much coarser kind do not seem to have been used for this purpose.

The little pebbles do not appear to me to have been mixed with the clay expressly to make it resist the fire more effectually. The clay of our modern cooking vessels is what is technically called ‘shorter,’ and is less pliant than that employed for other kinds of pottery, but the addition of pebbles as big as the end of the little finger would not improve its quality.

To the drinking vessels of pottery we may add three pretty goblets of stag’s horn; one like that drawn Plate CIV. fig. 10 has been already found at Moosseedorf, but the two others, figs. 13 and 14, appear to me to be new.

In our modern state of society the division of labour is carried to a great extent, and thus well-executed work is obtained at a cheap rate. It is not so in countries where civilisation is at a low grade; there every individual makes his own tools, and whatever implements he requires.

Our collection contains a great number of specimens which would not require for their manufacture more than a common display of skill, such as sharpened pebbles and coarse pottery made by hand; but there are a considerable number of specimens so well executed that we may attribute them to real artisans who had a special set of tools. This is the case with the hatchets and the hatchet hammers made with the pick and the saw, or perforated with the drill; also with the fine pieces of flint, which are so difficult to obtain by striking off flakes with the hammer; with the beautiful lance- and arrow-heads, but especially with the bronzes and pottery.

The imperfect specimens and those which were broken in the process of manufacture, the flint flakes, the 'skulls' or refuse of bronze casting, and the slag of copper, show that although the details of the work and many of the tools are as yet unknown to us, there was undoubtedly at a very early period an actual manufacture of implements on this very spot, probably before the appearance of bronze. M. Forel of Morges, and MM. Rey and De Vevey of Estavayer, will doubtless describe the moulds for casting hatchets contained in their collections. But few details have to be added to those which Dr. Keller has given as to the pottery.

We have already alluded to the choice and preparation of the clay for the cooking vessels or pipkins. Some specimens have been made by the hand alone, and others by the potter's wheel; but the quality of the clay has not determined the mode of manufacture. It may be well to mention that the vessels made by the wheel are in general of less coarse clay, but though the little pebbles would make it difficult to work, we possess one in very coarse clay, which has been made on the wheel, while others, either in fine or even very fine clay, have been made by the hand alone, doubtless before the potter's wheel was known.

A large number of bone points and chisels were used for making pottery. The great ribs with a natural curve, Plate CIV. fig. 21, would answer for hollowing out the large vessels in a regular form. One of the sides of a boar's tusk, Plate CIII. fig. 28, is the exact profile of small cups in our possession, and was used for finishing the inside evenly. Bone chisels, Plate CIII. fig. 38, and Plate CIV. fig. 17, were used for turning the pottery, and when a knife was required it was cut by a boar's tusk, Plate CIII. fig. 29, the enamel of which formed the cutting edge. When something more than the hand was needed, the simple ornaments of the period were easily made by scratching the vessels, when half dry, with the bone points, Plate CIII. figs. 33 and 38. The bone gouge, Plate CIII. fig. 40, was used to make the necks. In order to turn or fashion a vessel, like the beautiful one drawn Plate CIV. fig. 3, the potter must have made a piece of wood rather similar to the instrument of bone—half knife, half scraper—drawn Plate CIII. fig. 41. Many potters' tools of the present day are of bone, or of wood, and are so like those of the lake potters that they might be taken for them. Plate CIII. figs. 30, 31, 32, 34. A tool like the double-pointed instrument, Plate CIV. fig. 18, is still employed to make certain ornaments.

All the vessels are imperfectly burnt. The potter's oven was not used. The vessel was placed in the middle of the fire; the outside alone got burnt enough to become red. One of the large vessels we have must have been used as a charcoal brazier, for in the inside we find the red coating indicating that it had been perfectly burnt. The colour of the earthen vessels we have obtained is owing either to the degree of heat they have experienced, to the more or less ferruginous character of the clay, or to the use made of them: the well-burnt part is red, that imperfectly burnt is of a grey black, becoming deep black, as if when hot it was smeared with grease. It is easy to verify these facts by burning pottery in the manner of these lake potters. I have not been able to find any specimen coloured by 'ruddle' or red pigment, or graphite: one single fragment bears some trace of glaze, which can be easily detached in small scales. M. Bischoff, an intelligent maker of stoves in this town, from whom I have received much information, tells me that he believes common salt will produce a similar glaze.

Many of our lake potters were not only artisans, but artists; their productions are elegant, and of very varied forms; and their ornamentation shows considerable taste. Even the large coarse vessels made by hand have some ornaments, such as the impressions of the finger or the nail round the border or edge, or on the base of the neck; sometimes they consist of little depressions made very irregularly, apparently with a very small wooden point. Circular furrows more or less wide and deep may be seen on the vessels made by the wheel. The little dish, Plate CIV. fig. 3, with its circles, its irregularly broken lines, and the double chevrons on its flattened border, has a very pleasing appearance.

The bronze objects exhibit a still more remarkable development of taste than the pottery: the hilts of the swords, the lance-points, the bracelets, and the hairpins, are found in an astonishing variety of forms, and nearly every one of them is of a pleasing shape. The plates given in this volume, and still more a visit to the collections of the late Colonel Schwab or M. Troyon, will show how rich in ornaments were the castings and engravings even for objects of common use. The knife found at Concise, Plate CIV. fig. 20, is a beautiful specimen of the shallow engraving of the period, and of designs formed only of straight or broken lines, of circles, spirals, successions of dots, or portions of a circle, all tastefully arranged and entwined.

Amongst the objects found are some coming from a distance, which may give us information as to the countries with which the lake-dwellers had intercourse. It does not appear that any eatable commodity was imported. The water-chestnut (*Trapa natans*) which was at first thought to have come from the south has been found at Langenthal. But amber and tin have been found nowhere in Switzerland, and probably the same may be said of transparent jade (nephrite) and siliceous sandstone (lydite). Amongst the flints found at Concise there are some from the beds of the lower Neocomian, so common in our district, but the finest and most numerous specimens are the French gun-flint.

We cannot say that any inscriptions have been found; the little indentations, nearly half an inch long, sometimes single, sometimes double or treble, which are seen on some of the handles, are probably only marks of ownership. Our collections have no information to give either as to the language or religion of these ancient people, whose remains were first found at Meilen, as of a fresh Herculaneum; but the fact of their being obliged, with so much labour, to erect, in the water, groups of dwellings so difficult of access, indicates a very insecure state of society. The weapons of the chase probably were frequently used also in war.

Many of the specimens mentioned in these notes belong to Dr. Clément of St. Aubin; the others are deposited in the little museum of Yverdon. Dr. Clément was the first who drew attention to the antiquities obtained by the dredge from the lake at Concise; by his zeal and intelligence he succeeded in securing a considerable number, and he kindly threw open the whole of his collection, which has been a great advantage to me in preparing the present report.

L. ROCHAT.

Yverdon: Nov. 7, 1859.

Besides the antiquities described by M. Rochat, the late Colonel Schwab obtained a considerable number from these localities, some of the most interesting of which are drawn on Plate XCIV.

Fig. 3. A thin plate made of cast bronze with a ring at the top for suspension is from Corcelettes.

Figs. 4 and 5 are bronze knives, of which a great variety found in Western Switzerland may be seen in the collection of the late Colonel Schwab. The first is from Concise, the second from Corcelettes. They were not formed by the hand of the smith, but were first cast and then sharpened, like our modern scythes and sickles, not so much by being ground as by being beaten near the edge. This mode of sharpening is shown quite clearly in other cutting instruments of the bronze period, as, for instance, the sickles, the wings of the lance- and arrow-heads, and the swords and daggers. The tool drawn Plate XXXVII. fig. 5, from Nidau, may possibly have been a small anvil for this purpose. The bronze knives have very rarely the form of those now in use, which either terminate in a point or are rounded off at the end. In general they are curved or sloped like the sabres of many eastern nations, and bent very much outwards towards the point. The spike of the handle and the blade do not always form a straight line. The blade is sometimes broadest near the spike, as in those drawn Plate XCVI.; sometimes in the middle, as in the specimens under consideration. When the blade and spike are separated by an intermediate portion, as in Plate XCVI. figs. 2 and 11, there is usually a projection running to a point at the beginning of the blade. All the knives are very thick at the back, and are often strengthened like our scythes and sickles by a considerable additional quantity of metal. Plate XCVI. fig. 10. The ornamentation, which was preserved so long as the blades were sharpened by beating and not by grinding, is found not merely on the back, but also to a very considerable extent on the flat of the blade; it was made partly in the casting and partly by punching. Most of the knives had handles of wood or horn: some had incisions on the spikes to fix them more firmly in the handle. A few specimens, like Plate XCVI. fig. 14, have the metal part of the handle a broad plate with ridges or flanges at the sides, or have a spike bent round into a ring at the end, like Plate XCVI. fig. 10; in the latter case it would do for a cord to pass through, which the owner might fasten to his dress.

Plate XCIV. fig. 8 is a bronze pin, square in the middle, and running to a point at both ends; it was found also at Corcelettes.

Fig. 9. Bronze clothes' pin with a little cast ring at the top: this was doubtless fastened to the garment with a string. Found at Corcelettes.

Figs. 10, 11, 12, 14, 15, 16, 17, 18, 19, 20. Bronze pins with heads of various forms. It is remarkable that the engraved lines forming the ornamentation are made in a spiral form, not merely on the shank, but also on the head, in the pins drawn Figs. 10, 11, and 18. All these pins were found at Corcelettes.

Fig. 22. An implement of stag's horn with a perforated projection on the convex side, probably to receive a string: this was found at Concise. It is rather thick and coarsely worked, so that its use seems somewhat doubtful. Two specimens somewhat similar, but much longer and finer, are described by M. Rochat, and are considered by him as hairpins, as they are provided with a hole for a string to tie up the hair. See Plate CIII. figs. 20 and 21.

Plate XCIV. fig. 24. A small open armlet composed of three longitudinal portions; the two outer ones consist of a round wire bent over at the end to the left hand, and thus fastened at this end to the middle portion; at the other end the three parts are riveted together. It was found at Corcelettes. Lastly, we may mention that a Roman amphora was found at Corcelettes.

To the above list may now be added a few antiquities lately found at Corcelettes, and drawn on the following plates:—

Plate L. fig. 4. Bronze ornament for suspension.
Plate LIII. fig. 6. Bronze crescent cutting implement.
Plate LVII. Fig. 11. Bronze ornament for suspension.
Fig. 12. Ditto.
Fig. 13. Ditto.

THE 'LAKE DWELLING' CANOE OF CUDREFIN.

By Professor Grangier.[1]

'I first went to Cudrefin and spent two hours there, so that I am enabled to give you full information as to the lacustrine canoe found some months ago on the Vaudois side of the Lake of Neuchâtel, midway between Cudrefin and La Sauge. This valuable discovery was made by Corporal Petter, of the *gendarmerie*, who immediately informed M. le Préfet d'Avenches, and by his care the boat was with great difficulty taken out of the water and carried in several pieces to one of the offices of the Château of Cudrefin, where it is drying before it is sent to the museum of Avenches (the chief place of this district) or to that of Lausanne.

'The Cudrefin canoe is about 36½ English feet long, Plate LXXXVII fig. 3, from A to B, and about 2 feet 9 inches in its broadest part. The height in the middle is about 2 feet, the depth nearly 1 foot 6 inches, the thickness of the sides is 3 inches, and that of the bottom rather more than 4 inches. At the bottom of the boat there are four cross ribs, made out of the same piece of oak timber as the boat, and at a distance apart of eight or nine feet; that at the prow (nearest the letter B, fig. 4) is an actual seat, and is about 1 foot wide and 8 inches high; the three others are about 3 inches high and 7 inches wide. They were probably intended to strengthen the bottom. The sketches, Plate LXXXVII. figs. 3, 4, and 5, which I have endeavoured to make as exact as possible, will give the best idea of the different dimensions. As it would have been rather difficult, with my small experience in these matters, to give an idea of the different pieces which together make up this vessel, I have thought it best to draw it, not just as it is at the present moment, but as it was before it was taken out of the water. The most remarkable things about it, according to my ideas, are the part like a handle, and the prow, which are in very good preservation, B G, fig. 3. I may add that in the process of drying, care had to be taken to moisten the whole with a solution of salt, and that 25 lbs. of salt were used in this operation.

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[1] Extracted from the 'Indicateur d'Antiquités Suisses,' Oct. 1871.

'From Cudrefin I followed up, but with less success than last year, my researches on the different steinbergs or ténevières. I would beg you to understand that hardly any bronze is now to be found, but, on the contrary, in the stone age stations a pretty large quantity of stone wedges, flint implements, broken hammers, celts, and stag's horn tools were found. The only specimen which seems to me to deserve attention is a piece of stag's horn, one end of which is hollowed out to receive a stone wedge or some other instrument, while the other end terminates in a fork. I continued my excavation as far as Font, and as usual I succeeded in obtaining remains of all ages—amongst others five Roman coins of Augustus, Claudius Gothicus, Tacitus, &c. I also found iron arrow-heads and some keys.

'The Cudrefin boat has reminded me of what the fishermen of Estavayer have long since affirmed, and that is that a boat similar to this of Cudrefin was sunk in the sands of the bronze station called La Crâsaz, a league north of the town. Only one end of this boat—I do not know which—is to be seen more or less above the ground, and it is said that more than one attempt has been made to secure the whole. I have just given orders to make a fresh trial, which it is to be hoped may succeed better.'

GRENG (ON THE LAKE OF MURTEN OR MORAT).

THIS is a large settlement which bears some resemblance to that of Concise. Near the shore nothing is found but implements of the stone age, while farther in the lake we meet with a mixture of objects both of the stone and the bronze periods. It is almost entirely covered with reeds, and is partially an island; when the water is low it can be reached dryshod. The place was investigated in 1861–2, and no small number of stone hatchets came to light, some of them with unfinished perforations. A number of stone hammers were also found; corn-crushers, a stone mortar, six flint knives, clay rings, and fragments of pottery, a bronze ring and a hairpin, several implements of iron, and a great number of bones, some of which had been worked and some were entire. The implement of serpentine, combining the form both of a hammer and a celt, and drawn Plate XXXIX. fig. 5, was found here.

This settlement has since been carefully examined by the Count de Pourtalès, the Baron von Bonstetten, the late Colonel Schwab, Professor Desor, Mr. Jahn, and Dr. Uhlmann. The latter gentleman has given a detailed report of the place, of which the following notice is the substance; it will be seen that the antiquities found here when the settlement was carefully examined, all belong to the stone age.

'On the property of the Count de Pourtalès there is a tongue of land stretching in a northerly direction out into the lake. This place some time since was thickly covered with reeds and a few willow bushes, and on an average was under water four-fifths of the year. It is nearly of an oval form, and contains about 49,000 square feet covered with piles. The Count is making a small artificial island here, and to obtain material for this purpose, he is employing a mud machine to bring it up from the bottom of a channel formed all round the place, but especially between it and the mainland. By the direction of the Count all the antiquities which were brought up were carefully preserved and now form a small private museum in the castle of Greng. M. von Bonstetten, the late Colonel Schwab, and Professor Desor also obtained many antiquities here.

'The succession of the beds was as follows: First, a layer of broken pebbles and stones, rolled by the action of the waves; then a mass of the matted roots of reeds and rushes (*Scirpus lacustris*, L. and *Phragmites communis*, Trin.), after which the "relic bed" was reached at a depth of from one to four feet, containing as usual, bones, wood, &c. Beneath this the ground was loamy, and the original lake-bottom appeared, consisting of diluvial gravel. The piles in general went deep into the loamy ground; they consist of whole oak stems as thick as the arm or the leg, but some which are a foot in diameter have been split in two. In general they are well preserved, and they have been sharpened at the lower end by small, short, irregular, concave strokes of the celt. The wood is black, and has a sour marshy smell like all the mud and sand brought up from the bottom. The piles are placed irregularly: many of them stand close together; in other places several quadrangular areas, from twelve to twenty feet in length, may be seen covered with piles. The antiquities brought up by the mud machine were frequently broken, especially the bones and the more fragile objects; but more care was taken when a regular excavation was made, and great attention was paid by the Count and his steward, Mr. Gaberel, to preserve every specimen found here.

'All the implements found belong to the stone period: no specimen of metal came to light during this examination.

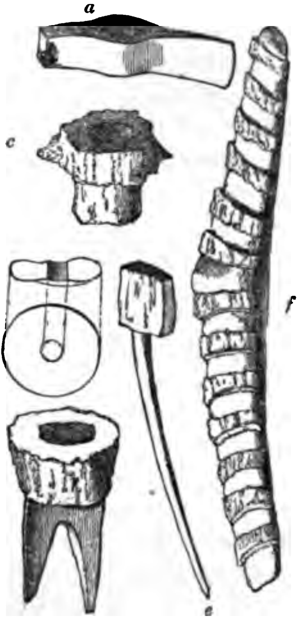
'Some flint dagger-shaped blades of considerable length and most excellent workmanship, chiefly of a black colour, and from 5 to 8 inches long, were found here, as also some implements like chisels and saws, and a few arrow-heads; some flakes and refuse were also met with, chiefly of a greyish-white colour.

'Some stone celts of the usual form and size were met with made of felspar and diorite in stone like serpentine; they were not particularly well ground. Others, however, were very carefully manufactured, and both ground and polished all over, amongst which are the perforated celts, serving both for hammer and axe (like those found at Estavayer in the Lake of Neuchâtel and in the north); one of them is represented at *a* in the annexed woodcut. Most of these specimens were in fragments; only about five were found whole. They were very neatly bored; the hole is round and everywhere of equal width. Some little perforated disks of stone were also found, each about

1½ to 2 inches in diameter and ½ inch thick: the perforation is circular, but is not everywhere of equal width: *b*.

'Many of the implements were made of bone. The well-known awls and piercers of various sizes, from 2½ inches to 1 foot in length, and ground to a sharp point, were made chiefly out of the metatarsal and metacarpal bones of the roe, the sheep, the pig, the cow, and the stag, or out of the fragments of bones of other large animals. To these we may add a few dagger-like points made out of the ulnæ of the stag, the wild boar, and oxen. Small bone tools, ground square, and chisel-shaped at both ends, were also met with, but not in any large quantity.

Fig. 26.



'A large proportion of the implements were made of stag's horn. Amongst them are the usual celt haftings, the sockets of which are chiefly made square to fit into the wooden handles: there is frequently a projection on each side as shown at *c*; all of them have been made very carefully with the knife, and very little ground. In some rare cases the socket is bifurcate, as shown at *d*. As far as I can remember, all the celts had fallen out of their haftings. A great number of points and awls, chisels, and spatulæ were made of stag's horn. A very carefully polished hairpin of the same material was found by M. von Bonstetten: the head is flat like a spade or shovel, but smooth and somewhat rounded off; the shank, which is round, is very finely polished, and rather curved; the whole specimen is about 3 inches long: *e*.

'A very rare specimen, the use of which is problematical, is in the Count's collection at the castle. It has been made out of a stag's horn somewhat curved, and is about 7 or 8 inches long. A portion has been split off on the concave side. The convex side is ornamented in a peculiar manner; a series of transverse furrows or incised portions run across the whole specimen, and between these furrows there is the natural roughness of the horn; this may be seen in the above woodcut, *f*. M. von Bonstetten thinks that this object may possibly have belonged to a bow, to the outer or convex side of which it may have been fastened by a thong which ran round the furrows, and thus bound both together.

'The specimens of pottery found here were chiefly fragments of the red thick earthenware, with grains of quartz in it, made by the hand alone, and badly burnt. Some few fragments of thinner ware also occur, ornamented with impressed lines.

'A very large quantity of irregularly-shaped broken pebble-stones of indefinite size and form were lying all about, which evidently had received their present form artificially. Most of them were rectangular, though somewhat rounded off; from the size of an apple to that of a man's fist. Many flat angular pieces of slate were also met with.

'The quantity of bones was so large that Mr. Gaberel had many hundredweights of them carted away. This quantity, however, was chiefly made up of undefined fragments, broken and hewn, as if in a butcher's shop. The longer ones are generally well preserved, but not so perfect as those found in the peat-deposits. The teeth especially were found in good condition in the jaws, and very singularly are bluish-grey, light, or dark blue in colour, especially those of swine; this may be owing to the acids contained in the marshy mud (impregnated with sulphuretted hydrogen) combining with iron, which probably is also present, and thus forming phosphate of iron as a colouring material.

'The animal remains are as follows: the bones of the urus (*Bos primigenius*, Boj.) are found only in very small fragments. The remains of a large variety of horned cattle, the domestic ox and cow (*Bos taurus*, probably the *Primigenius* race of Rütimeyer) are found very abundantly. The horn cores, jaws, and general relations of the bones are very like those of our modern larger race of domestic cattle. The very marked form of the small marsh cow is, however, not unfrequent (*Bos taurus brachyceros*, Rüt.). About one-third of the whole weight of bones consists of the remains of horned cattle. On the whole, the sheep cannot be called rare; in general the race has been a large one, with extremely strong horn cores, bent backwards and outwards, not unlike those of the ibex. The goat (*Capra hircus*) is found about as frequently, but is more slender in form. The remains of the stag (*Cervus elaphus*) are very abundant, a number of horns were found, the greater proportion of them perfect; amongst them are some of a strangely monstrous and abnormal form, and others of a very extraordinary size.

Some few specimens, such as portions of horns, belong unquestionably to the elk (*Cervus alces*). The fallow-deer has not been recognised here. The roe (*Cervus capreolus*), is of middle size, and is not abundant.

'I do not remember having seen any remains of the horse. The bones of swine are rather plentiful. The great size of the wild boar (*Sus scrofa ferus*) renders it easily recognisable, and so also is that of the marsh pig (*Sus scrofa palustris*, Rüt.), well characterised in old specimens by the short symphysis of the chin, and the general smallness of size. Both of them are found of all ages. Together with these are found a quantity of swine's bones intermediate in size, and of a looser or more open texture, and of molar teeth which are more rugged or protuberant, so that they appear to belong to the tamed or domestic pig.

'Amongst the carnivora, the great bear (*Ursus arctos*) with its powerful teeth takes the first place, but in the specimens now before me I can only recognise the teeth of the brown bear, perforated and probably used as amulets or ornaments. The remains of the dog are met with of the usual size, but larger than those found at Moosseedorf. They are not quite so abundant as the remains of the bear. A fox of the middle size is rather rare. The hedgehog and the beaver (*Castor fiber*) have been recognised, and the marks of the teeth of mice may often be seen on the stag's horns. The small bones of a frog (*Rana viridis*, or *esculenta*?) are unique specimens, and so are the scale of the perch (*Perca fluviatilis*), and of *Cyprinidæ*, the bleak, and the vertebræ of a large fish, probably the pike. Mixed with the bones and sometimes in the mud found in the hollows of the marrow-bones, I noticed many freshwater shells, probably belonging to the same age, viz.: *Valvata piscinalis Planorbis spirorbis*, and *P. nitida*, just as they occur not unfrequently at Moosseedorf. Lastly, remains of human bones have been dug up at several points in the area of the lake dwelling, and at a considerable depth. M. von Bonstetten possesses a perfect frontal bone of a boy hardly come to puberty. In the collection of the Count de Pourtalès there are similar specimens with (if I mistake not) pieces of the cranium; and I have in my possession a left femur and a right humerus, the first that of a middle-sized slender individual, probably a female, the latter of a somewhat younger person. The epiphyses are wanting in these two bones, both above and below, and the ends exhibit clear and indubitable traces of gnawing by some carnivorous animals, but whether by a small bear, or a great dog, or other beasts, can hardly be decided. As far as can be judged from a superficial examination none of the portions of the skull mentioned above exhibit any savage types, for the forehead is high and regularly arched.

'The heaps of bones very frequently show the marks of the celt upon them, and also the incisions made by sharp knives, especially the long bones, where the ligaments and tendons had to be separated when the animal was cut in pieces. As before mentioned many of them also show the marks of the teeth of carnivora and rodentia.

'The majority of the piles were probably of oak; there are however, some of ash, fir, birch, alder, and the common willow. A piece of bast was taken up from a great depth, but fell to pieces in drying. Amongst the other remaining plants may be mentioned hazel-nuts, beech-nuts, the stones of the sloe (*Prunus spinosa*); the bird-cherry (*Prunus padus*); the seeds of raspberries and blackberries (*Rubus idæus* and *R. fruticosus*); the hornbeam (*Carpinus betulus*); the white water-lily (*Nymphæa*); the strawberry (*Fragaria vesca*); and a Ranunculus. All these are unburnt. On the contrary, corn, probably the sort known as the lake-dwelling wheat, has been found in lumps burnt or carbonised. Burnt masses of vegetable matter and charred wood are not unfrequently met with.

'UHLMANN.

'Münchenbuchsee: October, 1865.'

Supplement to the Notice of the Lake Dwelling of Greng, on the Lake of Morat.

This settlement has been lately carefully examined by Mr. Susstrunk on behalf of the town of Morat and the Canton of Friburg. In consequence of the works for draining the marshes, the station was laid dry, so that the researches, made in the autumn of 1874, were relatively easy and very productive.

Amongst the specimens found, the following are the most worthy of notice:—

1. Two celts completely identical, 5¼ inches long, and 2¼ inches wide, 1⅛ inch thick. Their specific gravity is rather high, and they are of a deep blue colour, with a very characteristic metallic lustre. In shape they are exactly like the ordinary celts, which leads to the supposition that they have been formed on the same model. According to Professor de Fellen-

berg, they are composed of a mixture of carbonate of copper and sulphur, without any traces of tin. As there are always organic bodies in a state of decomposition in our lakes, the release of sulphuretted hydrogen which necessarily follows has transformed the oxides and carbonates of copper into sulphur, and this has given the blackish-blue tint to these celts.

These two specimens are especially interesting, as they initiate us into the early proceedings of the people of the stone age, who, though still ignorant of the advantages to be derived from the fusibility of metal, yet instinctively imitated the traditional forms which came daily before their eyes.

2. Several well-made studs or buttons of stag's horn. They are flat with rounded edges, and on one face have a small ear neatly cut in the horn.

3. A long hafting of stag's horn, with a conical stone of very hard rock inserted at one end. Probably this implement was used for boring.

4. A large piece of wood, in the shape of a half-moon, weighing about 7½ lbs., partly perforated in the centre; it may possibly have been used for driving the piles into the mud.

5. Two wooden objects, probably needles for netting, exactly like those found at Möringen, and described in the present volume.

Amongst the antiquities found here may be mentioned the thigh-bone of a stork, hollowed out so as to serve as a case for a bronze needle, Plate XLII. figs. 6 and 7.[1]

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[1] A case, precisely similar in every respect, was found at Marin, and is mentioned and drawn in the first edition under the head of 'Latest Discoveries.' Was it customary to keep needles in this manner? or is it possible that there has been any mistake as to the locality?

MONTELLIER (ON THE LAKE OF MORAT).

THE late Colonel Schwab obtained in this locality a number of stone implements, such as arrow-heads and flint knives : he also found some hooks, and hairpins of bronze. The most interesting specimens, however, are the earthenware vessels, which have been found here in great numbers, and at a considerable depth. A number of various forms and different ornamentations will be found drawn on Plates XCVIII. and XCIX. All the pottery from this settlement has been made by the hand alone, and not on the lathe, which is shown by there being no parallel striæ on the outside, while inside there are certain hollows arising from the material having been scooped out with a spoon-shaped tool; the sides also are of unequal thicknesses, and the central point of the base is not in the vertical axis, so that the vessel will not stand, especially if it is more than half full. These vessels have not been burnt in a closed furnace, but in an open fire; so that either one side is red, and the other black, or the upper and lower parts are of different colours; and they do not ring when struck. They are very neatly finished and smoothed, and sometimes they have been rubbed with graphite or charcoal till they shine. The ornaments, which consist of lines engraved more or less deeply, are all filled with chalk. In one single specimen, Plate XCIX. fig. 12, the ornamentation both on the outside of the bulge, and on the border both outside and inside, consists of strips of tin pressed firmly into the pottery; attention has already been drawn to a similar arrangement in the large earthenware plates or dishes, Plate XCI. and elsewhere. Only a few of these vessels have any actual foot or base, and those which are not made to stand have the lower part of the walls or sides thin and pressed inwards. The material consists of washed clay mixed in general with either fine or coarse quartz grains.

As may be seen from the specimens we have given, the vessels may be classed as cups or bowls, Plate XCVIII. figs. 1 and 11; Plate XCIX. figs. 2 and 5; jars, Plate XCIX. figs. 7, 9, 10; urns, Plate XCVIII. figs. 2, 3, 5, 6, 8, 9, 10, 13; and Plate

XCIX. figs. 1, 3, 12, and 15; basins, Plate XCVIII. fig. 4; jug-like vessels, Plate XCIX. fig. 8; and plates, Plate XCIX. figs. 11 and 13. Only the vessels like jars have handles, and only those like jugs have spouts. The oval plate, Figs. 11 and 13, was unique.

The line ornaments were made with fine or coarse pins; the impressed dots and rings with an instrument made on purpose. The lines running round the vessels and the hatched ornaments on the bulge are often very close together, and have been made with great care, though not always carried out with accuracy.

With respect to the ornamentation in general, we meet with no new forms. Impressed, straight, and curved lines, rows of points and zigzag lines, are found surrounding the vessels even in the stone age. In the bronze age this ornamentation appears richer, and a number of designs are met with such as the meander, the rectangle, the triangle, and the circle. (See the notices of the different lake dwellings, and also the account of the settlement of Ebersberg.) This kind of ornamentation appears most fully developed on the pottery of the Lake of Morat; the form is more elegant and varied than elsewhere, though more difficult to make, and it exhibits both taste and an advanced degree of skill. The ornaments as well as the forms of these vessels remind us of the products of the potter's art found in the lake dwellings of the Italian lakes and the Etruscan graves. (See Gozzadini, 'Sepolcri Etruschi.')

Only one vessel has a projection on the handle, evidently intended for placing the thumb upon, when carrying it like the horn-shaped or bifurcate appendages drawn on Plate CXIII.

Plate XCVIII. fig. 1 is of fine clay of a red colour.

Fig. 2. Has a shining black polish.

Fig. 3. This vessel is of red brown clay.

Fig. 4. Is of fine red clay.

Fig. 5. Is parti-coloured grey and red: very small stones have been mixed with the clay.

Fig. 6. The material is of the colour of the red Turkish tobacco-pipes and very heavy.

Fig. 7. A bowl with perforations at regular distances apart; the holes are vertically one above the other, and go through the sides; almost without exception these holes occur as in the present case in horizontal lines which run round the vessel.

Fig. 8. Is of fine black clay.

Fig. 9. Is of a grey colour; the double lines on the bulge, like all the other double lines, are in a depression or furrow.

Fig. 10. Is of fine grey clay with a deep incised hollow round the neck.

Fig. 11. On the bulge of this vessel there is a trellis-like ornament.

Fig. 12 and Plate XCIX. figs. 4, 6, and 14, are probably Spindle-whorls of which a large number were found here varying materially both in form and ornamentation.

Plate XCVIII. fig. 13. Is parti-coloured red and grey : small grains of stone were mixed in the clay.

Plate XCIX. fig. 1. The upper part is red, the lower black, the ornaments are unsymmetrical, and have been made by an unsteady hand.

Fig. 2. Is richly ornamented : the colour red-brown.

Fig. 3. Is reddish : the lines uncommonly fine. Two specimens were found of this form.

Fig. 5. Is richly ornamented : the colour red-brown.

Figs 7 and 9. Two views of a vessel of a black colour. The engraved lines, like all the impressed ornaments, are filled with chalk: the clay is mixed with small grains of stone.

Fig. 8. This vessel has a spout, and the border or rim is strikingly high, almost like a funnel: between it and the body is an incised hollow; the whole vessel has been polished, and is black and shining. The late Colonel Schwab had in his collection two other vessels with spouts from this locality.

Fig. 10. Is rather red and black: the clay is mixed with fine grains of stone.

Figs. 11 and 13. Two views of a black vessel of an oval form. Chalk is found in the impressions upon it, a proof that it was used for keeping dry stores.

Fig. 12. An ornamented vessel of a shining black colour, which contrasts strongly with the tin strips fastened upon it. The black lines in this drawing indicate these strips of tin, and are shown in the enlarged and more correct figure to the left of the drawing; *a*, *b*, *c* are thicker strips of tin within the border of the vessel.

Fig. 15. Half red, and half black, made of fine purified clay. Ornaments which reach down to the base are very rare.

The following specimens are all from the collection of the late Colonel Schwab of Bienne.

Plate C. fig. 4 is an object made of blackish clay like a trellis or lattice : the bars are elliptical in section, one side of them is smooth, the other ornamented with dots and lines. The use of this specimen is unknown.

Fig. 5 is the border of an earthenware vessel ornamented with bands of tin pressed into it; these bands, however, are in relief, as may be seen by the section, *a*, *b*, *c*, *d*.

Plate CI. fig. 1. A remarkable dish or cup made of clay, coloured black: it is about 15 inches across, and is ornamented on the inside with incised lines; the walls or sides are perforated in thirty different places with double rows of five small holes.

Perforated pottery has been repeatedly found in the lake dwellings, but in no other case are the holes so numerous as in this specimen. The lower figure shows the section.

Other objects of interest, however, besides pottery were found by the late Colonel Schwab at this station; the following specimens may be cited:—

Plate C. figs. 1, 2, and 3. Fragments of moulds for casting small bronze rings. Fig. 1 is made of clay. Figs. 2 and 3 are drawings of the same stone, and both sides have been used as moulds.

Fig. 6 is a flint arrow-head.

Fig. 7 is a bronze arrow-head.

Fig. 8 is the fragment of a ring of tin ornamented on the outside.

Fig. 9 is a small armlet or rather a clasp for the wrist made of tin.

Fig. 10 is a sewing-needle made of horn.

Fig. 11 is an ornament for suspension made of bronze.

Figs. 12 and 13 are bronze knobs.

Fig. 14 is an ornamented dish of thin bronze plate.

Figs. 15 and 16 are bronze screws.

Fig. 17 is a thin bronze plate.

Fig. 18 is a fragment of a bronze clasp or buckle.

Fig. 19 is a bronze ring.

Figs. 20, 21, and 22 are bronze fish-hooks.

Fig. 23 is a bronze ornament in the shape of a crescent moon.

Fig. 24 is an amber bead.

Plate CI. fig. 2 is a portion of a bronze knife.

A singular bronze ring with three ridges running round it was found at Montellier, but by some chance it has been drawn amongst the antiquities of Marin, Plate CXXXII. fig. 26.

MORGES.

We are indebted almost exclusively to M. Forel and his son for our knowledge of the lake dwellings and of the antiquities found here. They were first investigated in May 1854, after similar discoveries in the Lakes of Zürich and Bienne. The existence of piles here was however previously known, but no one knew what to make of them.

The following is a summary of the reports of MM. Forel on this locality:—There appear to be two distinct lake dwellings: the larger one opposite the town was first discovered, and the smaller one subsequently. It will be better to describe them separately; the first nearly in the words of M. Forel himself, the second in those of his son, Dr. F. A. Forel.

The lake dwelling opposite the town of Morges is one of the most considerable of all those found on the Lake of Geneva. The piles are seen in front of the town 400 or 500 feet from the shore at a depth of eight or ten feet below low-water mark. They are placed irregularly, and cover an area of about 1,200 feet long, by 100 or 150 feet wide. Horizontal beams are found amongst them, some of which have been worked by the hand of man. A canoe may also be seen half buried in the mud; this canoe is sharpened to a point in front, and apparently is formed of a single piece of wood hollowed out like the 'piroques' of savages: it is hardly more than 2 feet wide.

We have found amongst the piles a large number of antiquities similar to those in the collections of M. Müller of Nidau, and that of the late Colonel Schwab of Bienne, now united in the local museum of that town. Amongst the more interesting are the following:—A great quantity of vessels or fragments of vessels of earthenware of every variety of shape and size. Some are very small and others very large; in a few cases they measure 2 or 3 feet across. In general they are made of coarse clay mixed with little white pebbles. Some of the small vessels are made of a finer clay and covered with a sort of black polish, the appearance of which reminds one of graphite. Most of them are broken, and this may easily be imagined, for the place where they are found is frequently disturbed by the boat-hooks or iron pikes used by the boatmen. A large number of 'torches' or rings of baked clay have been found here.

The bronze objects are of great interest: about 130 specimens have been obtained, such as celts, swords, knives, sickles, lance-points, bracelets, hairpins, &c. Some of them are beautifully formed and very well preserved.

A mould for casting bronze celts which was found here merits most particular attention on account of the singular circumstances attending its discovery, and M. Forel's account of it deserves to be given in full. He says:

'I found the first half on February 25, 1855, and I despaired of finding the remainder, till, after an interval of four years, my son was fortunate enough to dredge it up October 18, 1859. The two halves agree, and fit exactly to one another.

'The mould itself is of bronze. It is drawn Plate XXXIX. fig. 6, and different views are given, figs. 7 and 8; it weighs four pounds, and is 7½ inches long. One may recognise at a glance the form of the celts with four wings (fins or projections), which have been found at Morges, Bienne, and other places. On one side it has the hollow for making the loop, found on a great number of celts. On both sides of the upper opening may be seen two little lengthened hollows, for the introduction of the melted metal, corresponding with the appendages in the form of points, also found on several celts, but which are generally bent down or broken. I have not been able to satisfy myself as to the use of these appendages. The "adjusting points" of the mould are very well marked; and along the sides of the first half there may be seen a longitudinal projection corresponding with an analogous groove on the other half; this arrangement seems intended to prevent the escape of the melted metal.

'There have been found at Morges forty-two bronze celts of the same type, of different sizes and patterns. The largest is 7¾ inches long, and weighs a pound and a quarter. The smallest is 4 inches long, and only weighs six ounces. All these instruments vary considerably, and appear to have been cast in a great many different moulds. The mould we have found would answer for the medium dimension of about 6 inches. At first I thought that many celts of the same size, the shape of which was extremely analogous, had been cast in this mould; but since I obtained the second half, I have cast in it a leaden celt, and I am now convinced that it presents characteristic differences. The loop is placed lower, and between the 'wings' may be seen a little projecting cross, which is not met with on any of the celts which we have found. This cross was probably the founder's mark.

'I would particularly call the attention of antiquaries to this mark, as it may enable us to ascertain whether there are any celts in other collections cast from the same mould.

'The wings have been *cast straight* for the sake of being got out of the hollows more easily; they were afterwards curved by means of a hammer. The cutting edge when taken out of the mould would in some degree be thick or blunt; it would afterwards have to be hammered and sharpened on a grinding-stone; the operation of hammering probably helped to harden the metal.

'The first half of the mould shows on the outside some very strange roughnesses or projections in the metal, which I had some difficulty in understanding. At first I thought that they were the remains of a hinge, but nothing analogous was found on the second half, and I have convinced myself that the appearance merely arose from pieces added to remedy defects in the first casting.

'This instrument, which is very remarkable in every respect, is made with much skill, and shows considerable dexterity in the art of casting. Was there a permanent foundry at Morges, or did this mould belong to some itinerant founder who travelled from village to village as our tinmen do at present? We cannot decide this with certainty. But what does appear evident is this: as the mould was found at the lake-bottom, the ancient settlement of Morges has probably been destroyed by fire or some other catastrophe. For in any other case it seems unlikely that an. object of so much value would have been allowed to be lost by carelessness. The great number of celts found at the same time also bears out this supposition.

'I will make two more remarks. First, the piles which have been drawn up at Morges all appear to have been sharpened by small metal celts similar to those we have found. Secondly, if bronze moulds were used for casting such a large variety of celts as we have met with, this fact would indicate a very advanced state of the founder's art; but we may suppose that a part of these instruments were cast in simple earthen moulds, and this supposition will reduce the development of industry at this period to more moderate and probable limits.

'I only know of two moulds for casting celts, one found in

England and the other at Quetetot, in Normandy. Both these, however, were for casting socketed celts, and I do not know of any one for making winged celts like ours. It would be interesting to ascertain in what countries similar celts are found. I have seen it remarked that this form is not rare in Italy, but I have noticed none in the collections of the south of France, and I shall be anxious to know whether they are to be found in those of the north of France and of England. I do not exactly know why, but it seems to me that wherever the primitive population of ancient Helvetia may have sprung from, we must always look towards the south to find the starting-point of their civilisation.[1]

'Amongst the objects in stone is a weight with a hole through it. Several stone disks have been found with a groove round the edge like that of a pulley; also many round stones like little bullets, and other round stones worn on some of their faces. I have not been able to determine with certainty how these different specimens were employed.[2]

'Several whorls or little disks of baked clay were also dredged up; they are now generally thought to have been whorls for spinning flax or wool.

'Many animal remains were found here, such as stag's horns, bones, and teeth. From all these relics we can prove the existence of the stag, the deer, the goat or the sheep, the horse, and the pig or wild boar.

'We have not found any arms or implements of the stone age, and we have no reason for suspecting their existence; it ought, however, to be mentioned that we have not trenched below the surface of the lake bottom. On the other hand, we have found no implement of iron.'

Such is the substance of M. Forel's report on the large lake dwelling opposite to the town of Morges. This locality was also investigated by M. Troyon and Professor Morlot. They procured numerous clay rings and fragments of pottery, two celt rings, animal bones, and charcoal, all of which apparently were similar to the things obtained by M. Forel; but they found also a little object in silver like a necklace bead, which appears to be peculiar as it is the only specimen of this metal hitherto found here.

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[1] Several celt moulds both of bronze and stone are drawn by Mr. Du Noyer, in the 'Archæological Journal,' vol. iv., p. 327. The bronze moulds are chiefly for casting socketed celts, but there are two stone moulds for making winged celts, both found in Ireland. The ornamentation on some of these celts drawn in this very interesting paper is most extraordinary, and might enable a wayward antiquary to argue that civilisation came from the north instead of the south. Several other celt moulds are mentioned by Mr. Du Noyer in a note, and much information also is to be found in Sir W. R. Wilde's catalogue of Irish antiquities, and also in the beautiful volume lately published, called Horæ Ferales.—[Tr.]

[2] The pulley-like stones are evidently the problematical antiquities called sling-stones, respecting which some observations have been made elsewhere in this volume, p. 140, though it must be confessed that our knowledge about them is very unsatisfactory. The round stones worn on one or two faces were doubtless corn-crushers.—[Tr.]

The second lake dwelling at Morges has been described by Dr. F. A. Forel, and the following is nearly an entire copy of his report:—

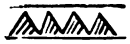
'The smaller settlement of Morges, called Les Roseaux, is only a few hundred paces distant from the large one opposite to the town which has been described by my father, and yet it differs very essentially from it. Since my father wrote his account the researches of M. Carrard of Lausanne, and the working of a mud machine on the locality, together with our own excavations, have thrown considerable light on the station; but the problems raised concerning it are still far from being solved.

'Alongside the great settlement of Morges, so rich in bronze implements of nearly every kind, we find a lake dwelling called Les Roseaux, which affords us in fact objects of stone, of bronze, and of iron. The bronze celts and the pottery found here are of quite different types from those of similar materials from the great neighbouring settlement, so that it is difficult to determine its place in the archæological series.

'The specimens found here are as follows:—

'Two fine stone celts sharpened and polished, now in the museum of Lausanne; some flint refuse was also found.

'Fifteen bronze celts of the spatula type, with the cutting edge wide and rounded, and rudimentary ears or wings simply indicated by two small flanges. A celt of this form has been found near the 'Pierre de Niton' in the port of Geneva. This form which is very abundant in the south of France is rarer in Switzerland, and yet it has often been found in the remains of lake dwellings. It is similar to those drawn Figs. 2 and 3, Plate CXI., from the Terramara.

'Pottery is rare at Les Roseaux compared with the immense quantity of vessels found in the first settlement of Morges. The vessels met with at Les Roseaux are of two types: one exceedingly coarse with thick walls or sides, the clay of which is mixed with little grains of silex; they recall to one's mind the irregular vessels of some of the stone-age settlements, or the fragments of pottery found in caverns associated with flint implements; they cannot at all be compared with the very large but extremely well-made vases of similar material from the large settlement. The second type consists of finer vessels, better designed, and always with characteristic ornaments, most frequently with patterns round the border like the following woodcut  which we have only met with at Les Roseaux. These latter vessels have flat bases, and are totally distinct from the Celtic goblet with a conical base, which as it would not stand by itself had to be placed in a ring of earthenware.

'Several little flat stones rounded and perforated like that from Meilen, drawn on Plate III. fig. 13. These whorls are always of stone at Les Roseaux, while in the great settlement of Morges they are of earthenware.

'Many iron sickles of different shapes, some of them like those found in the station of À la Tène or Marin.

'A considerable quantity of bones, the greater part entire and not broken by man, nor has any attempt been made to obtain the marrow; the marks of the knife used when separating the flesh and the tendons may frequently be seen upon them. The species found here are the ox, the bear, the stag, the roe, the sheep, and the marsh pig.

'The piles are of oak and fir; they have been hewn with a bronze celt, and the cutting marks left upon them enable us to decide they were brought to a point by means of the spatula-like celt or hatchet mentioned above, and not by the great bronze celt with ears. We have had the opportunity of examining a considerable number of these piles brought up by the dredging machine, and we have never seen any cutting marks characteristic of the strokes of the stone celt.

'We may add that the settlement is of some extent; it is more than 200 paces long; the industrial relics are not very abundant, and the dredge brings up few remains of pottery and charcoal, indicating that the settlement was not inhabited for a lengthened period. With these facts before us, and bearing in mind the value of the antiquities, we have to resolve the following problem: At what age are we to place the settlement of Les Roseaux; and as, in the absence of what is positive, archæology is obliged, like geology, to be content with relative dates, the question resolves itself into this: Was the station of Les Roseaux anterior to the great lake dwelling of Morges?—Was it contemporary with it? or was it of later date?

'Was it anterior? The presence at Les Roseaux of stone celts and flint refuse, which have not been found in the other settlement, the form of the bronze celts, which approach nearer the shape of the stone celts, than that of the regular celts with ears, and the small advance made in developing the manufacture of bronze, all seem to indicate that it was so. But on the one hand the piles have not been cut by stone celts, and on the other the presence of iron sickles seems to indicate that this station was occupied up to a comparatively late period.

'Is it contemporary with the great settlement of Morges? The presence at Les Roseaux of the three materials characterising the three ages—of stone, of bronze, and of iron—would almost lead us to place this station in the intermediate age, or that of bronze, the stone implements continuing as memorials of past days, and the iron being introduced as a recent acquisition of industry. But how can we then explain the difference in the types of celts and pottery? How, especially, can we explain there being no barter or exchange between the two settlements, and how is it that we have never found spatula-like celts in the lake dwelling of Morges, nor eared celts in that of Les Roseaux?

'Is it later? The iron sickles and also another piece of iron of indeterminate shape both found at Les Roseaux form rather a large proportion of the few artificial objects found in this station. On the contrary, in the lake dwelling of Morges, so rich in bronze objects, iron is only represented by a single authentic specimen, an iron poignard analogous to that drawn by M. Rabut in his work on the lake dwellings of Savoy, plate xvi. fig. 1. From this it would appear that the great settlement of Morges belonged essentially to the bronze age, while that of Les Roseaux lasted till the introduction of iron. But this hypothesis is refuted by the presence of stone implements, and by the relative imperfection of the pottery, which indicates a low grade of civilisation.

'In fact none of these three alternatives seem independent of criticism; not one corresponds exactly with all the facts observed.

'Two other suppositions may be made to explain the anomalies presented by this settlement.

'Either the station of Les Roseaux was contemporary with that of Morges, but was inhabited by a race of different origin, having other manners and customs; or by a peculiar cast (such as a sacerdotal tribe), or by a distinct workman's corporation, for example, of butchers or tanners. In any one of these cases the difference in the type of the implements would be partially explained.

'Or, this station has been a little anterior to that of Morges. The spatula-like celts brought from the south of France had only just taken the place of the ancient stone celts when the settlement was erected. It only existed for a short time; burnt or destroyed by a hurricane it disappeared. The great lake dwelling of Morges was erected some short distance from its site, and its inhabitants or some other colonists before unknown may have come to the locality of the first settlement to gather the reeds which still grow there abundantly; they may have dropped some of their sickles in the water, which may be the very implements we find at the present day.[1]

'We must confess that these hypotheses are of no great value; but still we are obliged to have resort to hypothesis, and we have only to wait until fresh discoveries either confirm or disprove them.

'F. A. FOREL.

'Nov. 10, 1865.'

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[1] It appears to us that the difficulties which surround the question of the age of this settlement can best be met by the theory of the fortuitous admixture of antiquities belonging to a later period with those of earlier times.

Such an admixture of earlier with later types must be especially liable to arise where the investigation has to be carried on, as in this locality, by means of the dredge, at a depth of from 8 to 10 feet beneath the surface at low water.—[TR.]

The reader is referred to the following paper by the same author for all the latest information respecting this settlement, and several others on the shores of the Lake of Geneva.

NOTES ON SOME LAKE DWELLINGS ON THE VAUDOIS BANK OF THE LAKE OF GENEVA.[1]

BY PROFESSOR F. A. FOREL OF MORGES.

I. THE SETTLEMENTS OF MORGES.

THE interest attached to the recent study of the lake dwellings of Morges has not arisen so much from the discovery of valuable implements or ornaments—for in this respect these stations have been nearly worked out—as from the clue which they offer to the determination of their relative ages. There are few places where the archæological eras are so well or so clearly defined as at Morges, and a rapid review of these stations will enable us to draw some general conclusions.

At the present time we know of three different lake dwellings placed side by side in the gulph of Morges, within a distance of about eleven hundred yards, and though situated in immediate proximity to each other, yet they belong to three distinct ages.

1. What is called the 'Great City of Morges' was discovered by Messrs. Morlot and Troyon, on the 22nd of May, 1854, and since that has been investigated by Messrs. H. Carrard, C. Monod, and ourselves. More than four hundred and fifty specimens of bronze have up to the present time been found in this large settlement, and they all belong to the purest type of what M. Desor has called the '*bel âge du bronze.*' In order to mark its character as essentially distinct from the lake dwelling of Roseaux which we are also about to describe, it may be stated that in the 'Great City of Morges' we found more than sixty bronze winged celts, but not a single specimen of the spatula-formed celts so characteristic of the other station.

2. Between the shore and the 'Great City of Morges,' but separated from it by a sterile band about two hundred and

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[1] Although there can be no doubt that in these notes some things are repeated which appeared in the Notice of Morges, which was given in the first edition of this work, and which has been reproduced in this one, yet there is so much which is new and interesting in the present report that it has been translated almost entire.—[TR.]

twenty yards wide, there is a circular space, to which we will give the name of the 'Lake Dwellings of the Church.' In many respects this settlement resembles the *ténevières* of the Lake of Neuchâtel, or the steinbergs of the Lake of Bienne, as the whole of the lake-bottom occupied by the piles has been decidedly raised by a mass of stones or gravel brought here for that purpose, but the depth of the water even when the level is low is two or three yards; rather deeper than that which covers the *ténevières* on the lake of Neuchâtel. A singular arrangement of these masses of stones is observable, but which has not, to my knowledge, been before mentioned. In more than twenty or thirty different places in this raised stone mound, and occurring quite regularly, there are found very characteristic depressions. These hollows are rectangular or oval-shaped, and are from 13 to 20 feet in diameter, in which no stones are to be seen, but instead of them the normal lake-bottom either of mud or clay, as the case may be. These hollows are surrounded by a wall of stones heaped up 8, 12, or even 20 inches high, forming very distinct and evident lines between the depressions. The size of these heaps is by no means uniform. The hollows are for the most part found in rows, and they would appear to correspond with the sites of huts or distinct houses placed as it were in lines or streets. The 'Settlement of the Church' is of the stone age, which may be proved by the remains of human industry discovered here, such as about twenty stone celts, what are called spindle-whorls of sandstone, grinding-stones of molasse rock, some fragmentary remains of pottery few in number and badly manufactured, and finally by the entire absence of all metal.

3. The settlement of Roseaux is situated about 440 or 450 yards from the northern extremity of the 'Great City of Morges,' the principal characteristics of which are given in the previous pages (pp. 299–302); we may now continue them as follows: A mixture of implements of stone and of bronze (and also of iron)—the bronze is represented by types very unlike those of the '*bel âge du bronze*,' and more especially by eighteen celts of the spatula form without wings, and consequently very different from the heavy-winged celts of that famous station. The question then may be asked—To what age are we to attribute this settlement? Was it anterior to that of the 'Great City of Morges,' as the stone celts found there would seem to indicate, or was it posterior? And ought it to be considered as belonging to the iron age, as may be argued from a considerable number of iron sickles found in this lake dwelling? This

question has now been decided—the station of Roseaux is earlier than that of the 'Great City of Morges'; as may be shown from the following facts.

a. The discovery in the lake dwelling of Roseaux of a large number of stone implements (celts and arrow-heads).

b. The very rude character of the pottery, which is peculiar both in form and ornamentation; these facts, and also the clay from which it was made, lead us to refer it to the age of stone.

c. The rather primitive character of the bronze hatchets or celts in the form of a spatula, a type which is much less perfect than that of the winged hatchet.

d. The fact that a similar hatchet or celt was found at Meilen, in a station most unquestionably of the stone age (see page 24); another was found at Concise under the same conditions, and formed part of M. Troyon's collection with respect to the lake dwellings of Unter Uhldingen (see page 122), and the *Terramara* of Italy (see page 393); they all come from stations where there is a mixture of stone, bronze, and even iron objects; consequently, their age is undetermined, and they will not help us to fix the date of this form of implement.

e. The entire absence of every other bronze implement, with the exception of two very small thin plates, lancet-shaped, about three inches long, which possibly may have been the points of a lance or javelin.

f. Lastly, the fact that the iron sickles found here are of very different types, and belong to several different ages. Some of them are even modern, and their presence here may be quite easily accounted for, as on the site of this very lake dwelling there is a bed of reeds which from time immemorial the inhabitants of Morges have cultivated and cut for sale.

These arguments taken together are sufficient to dispel all doubt on the subject.

Another fact appears very clearly in these lake dwellings at Morges, probably more so than elsewhere; and that is the absolute independence of these stations one of another—there is no trace of any mixture of characteristic implements.

In the settlement of 'the church' the stone age is distinctly marked; none of the spatula-formed celts or hatchets so common at Roseaux are found there. Now these two settlements are not five hundred yards apart, and it is difficult to believe, however poor the settlers at the station of 'the church' may have been, that if the two lake dwellings had been contemporaneous not a single bronze hatchet would have found its way into this wretched station.

Again, in the station of Roseaux, we find all the characteristic marks of the civilisation of the stone age—stone celts and arrow-heads, spindle-whorls of sandstone pottery made of coarse material, badly worked and coarsely ornamented. Consequently, the station of Roseaux belongs to the stone age. But bronze had begun to appear, brought without doubt by the wandering colporteurs, or taken as booty in the pillage of a hostile tribe. The spatula-formed hatchets or celts, and the plates of bronze found there, indicate the introduction of the precious metal.

But yet we cannot connect the settlement of Roseaux with the 'Great City of Morges.' In the first place because its general characters belong to the stone age—though this argument is not decisive, for it might be said that it was a poor village, somewhat behind the rest of the world; but chiefly because not a single implement, utensil, ornament, fragment of pottery, or spindle-whorl of the types so characteristic of the 'Great City of Morges,' has been found in the station of Roseaux.

Chronologically speaking, in the series of ages, in the development of civilisation or of commercial exchange, the settlement of Roseaux belongs then to a peculiar era, and if we may take it as the type of a period, it represents the *second age of stone* in the lake dwellings, that is, the end of the stone age, marked by the first appearance of bronze. If it were desirable to give greater importance to the introduction of this metal it might be called the first age of bronze.

Lastly, the 'Great City of Morges' is the purest type of the '*bel âge du bronze*,' and one in which the bronze objects are most artistically worked. Not only is there in this settlement no mixture with the objects of other ages—not only have we never found here a single stone celt, nor a single bronze celt of the spatula form, nor a single well-defined implement of the iron age, so that we are consequently authorised by this absence of other metals and materials in placing the settlement in the middle of the bronze age, but, in addition, the products of human industry found there, possess a beauty of form and a purity which characterise a high degree of civilisation. The potters who turned out their well-formed goblets with a conical base, and the founders who were able to model such elegant bracelets and a reniform ring so highly ornamented, and such well designed lance-heads and knives, were artists in the true meaning of the word, for they had a feeling for the beautiful—they sought for beauty of form and they knew where to find it.

It was otherwise in what may be called the third age of bronze, just before it vanished at the appearance of a new metal. Iron had come to light and bronze disappeared. The civilisation which we have noticed above as so refined is in decadence; the forms became more complicated, more far-fetched, and consequently less pure—the processes improve, but taste disappears. The '*bel âge du bronze*' is finished when we find ourselves in the first iron age.

This absolute independence of our settlements at Morges and the complete freedom from any mixture of the characteristic implements are of great theoretic value. They exhibit at one glance the reality of succession in the ages of the different archæological eras; they completely refute, at least as far as our country is concerned, the idea which was long held of the contemporaneity of the different ancient civilisations as if they had coexisted in neighbouring villages but under different circumstances. In fact, it is evident to us that when the 'Great City of Morges' was erected, the station of Roseaux had not only been destroyed, but even its ruins were no longer visible above water, and the memory of it had completely vanished. If this had not been so, we could not explain why the fishermen of the new settlement should not have gone to Roseaux to search there for the bronze celts which we have discovered. Bronze was at that time certainly more valuable than in our days, and these celts would undoubtedly have been an actual treasure.

This rather long dissertation may we hope be excused by the fact that in determining these relative ages we differ in some particulars from the author, who has taken as his standing ground the same monuments as we have just described. M. G. de Mortillet, in his *Tableau Archéologique de la Gaule*, published in 1875, has laid down the following series of ages:—

STONE AGE	PALÆOLITHIC PERIOD, NEOLITHIC, OR THE FIRST LACUSTRINE AGE	Era of Robenhausen.
BRONZE AGE	SECOND LACUSTRINE AGE	Era of Morges, or age of the founder station of Roseaux.
IRON AGE	AGE OF THE TUMULI	Era of Larnaud, or age of the coppersmith and of the hammerman. The 'Great City of Morges.' Era of Hallstatt, &c.

We quite agree with M. de Mortillet as to the interest and the correctness of the division which he proposes. As to the reality of the chronological succession, there cannot be a doubt. But we differ from him a little on the two following points:—

1st. We place our settlement of Roseaux, which M. de Mortillet considers as the type of the age of Morges, not in the age of bronze, but in that of stone; as we have already remarked that the culture and general civilisation were those of the first lacustrine period. Everything recalls to us the age of stone, with the exception of some metal celts and thin plates, which show to us that bronze had already begun to appear. But the introduction of a few tools of a raw metal are not sufficient at once to change the civilisation or suddenly to modify the manners and customs of a whole people. Because a savage in an island of the Pacific Ocean has obtained from a sailor an iron nail which he has made into a lance-head, it does not follow that his tribe has passed from the stone age to that of iron.

The same observation might be applied to the first appearance of iron towards the end of the bronze age; but the discussion of the cases which support this view would lead us too far away from the stations of Morges.

2ndly. In order to characterise the two ages of bronze—that of Morges and that of Larnaud—M. de Mortillet calls the first the age of the founder, and the second the age of the smith or the hammerer. To this we object. When the settlers at Roseaux got their first bronze implements, probably by means of foreign colporteurs, one can hardly say that the founders did not know how to hammer bronze, for not only the cutting edges of the bronze celts have been hammered, but even the little plates found in this station are so thin and fragile that they can hardly have been made by casting in the state we see them. On the other hand, speaking only of lake dwellings, our 'Great City of Morges,' which is one of the purest types of the '*bel âge du bronze*,' has yielded to us but few specimens positively hammered, for, besides the edges of the cutting implements, the whole of the hammered specimens consisted of one ring, two or three bracelets, and a horse's phalera or stud. By far the larger proportion of bronze objects have been cast, and only cast. We most certainly acknowledge that, in proportion as the bronze civilisation was developed, it became more and more usual to hammer the metal; but between the transition period, called the age of Morges by M. de Mortillet, and the '*bel âge du bronze*,' or the age of Larnaud, the differences with respect to hammering and casting bronze are in our opinion not great enough to justify a separation of these two ages based on the introduction of the smith's art.

Taking all these particulars into consideration, we should prefer the following chronological arrangement of the series under consideration:—

Periods	Ages	Eras of M. de Mortillet	Examples in the lake dwellings
Palæolithic period	A chronological lacuna in the actual state of our researches.		
Neolithic period .	Age of polished stone . .	Age of Robenhausen . .	Station of 'the church.'
Bronze period .	First appearance of bronze .		Station of Roseaux
	'*Bel âge du bronze* . .	Age of Morges . Age of Larnaud .	'Great City of Morges.'
Iron period .	First appearance of iron . .		Auvernier, Cortaillod, Möringen, &c.
	First age of iron &c. . .	Age of Hallstatt.	La Jène.

In thus arranging the archæological eras, we would draw attention to the fact that between the neolithic period and that of bronze, and between the bronze age and that of iron, periods of transition may be ascertained passing gradually from one to the other, showing the chronological continuity of the development of civilisation, and proving that in this series there is nothing analogous to the chronological lacuna, which in the present state of science still separates the palæolithic from the neolithic period.

The following are the more remarkable objects found in our stations at Morges since the sixth report published by Dr. Keller (i.e., since the publication of the first edition of the present work):—

In the 'Great City of Morges'—

A large *reniform ring*, Plate LXVIII. fig. 1. It is too richly ornamented to be considered a weapon. It has been cast hollow, and is therefore too light to be taken in the hand and used for boxing, and it is of such a shape that it never can have been used as a bracelet. The hypothesis which we published at the time of its discovery (*Indicateur d'Hist. et d'Antiq. Suisses*, 1866, *No.* 3) still appears to be the best explanation. We imagine that these reniform rings may have been badges of command, carried in the hand, or possibly they were analogous to the *armilla sacra*, *Schwur-ring*, *anneau de serment*, on which the ancient Germans and Scandinavians placed their hands when they wished to swear a solemn oath.

A ring of the same kind, but with the furrows and lines on it very differently arranged, was found by Professor H. Carrard in the lake dwelling of Thonon. Plate LXVIII. fig. 2.

One of the large buttons or studs, beaten and hammered, which have been considered as studs for a horse's harness.

A knife, curved back at the end, and furnished with a handle, probably intended to carve wood like the analogous implements of the present day. Plate LXIX. fig. 3.

Eighteen bronze celts of the spatula form have been found in this settlement up to the present day. They are somewhat different from those found in other lake dwellings of Switzerland and Italy, and more like those which we have seen in the archæological collections of Languedoc and Provence.

The following antiquities, which appear not to have been previously mentioned, have been sketched to complete the list of the discoveries at Morges:—

Plate LXVIII. fig. 3. A great bronze hook.
Plate LXIX. fig. 1. Bronze armilla.
Plate LXXXVIII. fig. 3. Bronze 'crochet'-hook.[1]
Plate LXXXIX. fig. 7. Socketed bronze celt.
Fig. 8. Ditto.

II. THE LAKE DWELLING OF NYON.

There are two stations of different ages in the Bay of Nyon: that known under the name of *Promenthoux* is of the stone age; the other, called the station of Nyon, belongs to the '*bel âge du bronze.*' Both of them have been carefully examined by M. Fauconnet, of Nyon.

Some years since M. A. Revilliod found in the station of Nyon a specimen of great interest. It is a chain or necklace, consisting of about three hundred bronze rings, independent one of another, but joined together by the calcareous deposits which normally encrust every piece of metal lying for any length of time beneath the waters of the lake, which possess a slightly lapidifying property from the lime they hold in solution. The diameter of the rings gradually diminishes from eight inches to about seven inches, and the thickness is from six hundredths to eight hundredths of an inch. They are slightly flattened on the plane of their circumference, and they were all cast, and on the same model apparently, if we may judge from the position in which they were found, as they were strung on a cord. The whole formed a necklace about twenty-four inches long, and would nearly go twice round. The cord has rotted away, and the rings remain joined together by the tufa.

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[1] A friend points out that the articles figured on Plate CXXXVIII., were probably made with such an instrument.—[Tr.]

What is the meaning of this chain of rings? How are we to explain it? Three modes of explanation may be imagined:—

1st. It may have been an ornament—a necklace. This is possible, and the similarity of the different rings forming the chain seems to argue in favour of this explanation. If so, it would be the richest and most valuable ornament yet found in our lake dwellings. The only objection which I have to make to this hypothesis is, that if this chain had been a necklace, a wish to economise the metal and to diminish the weight of the ornament would have led the founder to flatten the rings, not sideways, but at the circumference; in fact, to make of these rings a series of little cylinders rather than a number of flattened disks with holes through them.

2ndly. We may imagine it to have been the stock-in-trade of a wandering hawker—a dealer in rings or links intended to be sewn on to the clothes, or worn in some other way. Under this view, the ring merchant with his stock-in-trade had been caught in the lake dwelling of Nyon, when it was destroyed by the enemy.

3rdly. Lastly, we may imagine these rings to have been pieces of money, and that the chain of rings was of actual commercial value. I will not repeat the arguments brought forward by M. Desor to prove that the rings found in our lake dwellings represented real money. The large number found in our settlements, the great variety of size, frequently quite unfit for the human finger, the internal edge, which is very frequently sharp or cutting, and the fact that at Auvernier and Cortaillod a number of these rings have been found strung together on the same wire, so that M. Desor inferred that this collection of rings was a kind of lacustrine *porte-monnaie*; and, lastly, the analogy with the Chinese money. All these arguments apply to the rings found at Nyon.

There is, however, one objection to make, and that is that all these rings are similar one to the other, and do not vary in their patterns like most of the other rings found in the same lake dwelling. This fact goes against the idea of their having been current coin, which would imply a collection of pieces of money of different types and origins brought together by the chances of commerce into the hands of the same proprietor, unless indeed we could venture to suppose that it was a deposit of money made immediately after it had been issued and before it had passed through several hands. In any case, this objection seems to have some weight, and ought not to be passed over.

I will not venture to decide which of these three hypotheses is right, but content myself with having described this very curious chain. Unfortunately it is broken into six or seven fragments. The specimen is in the collection of M. Aloïs Revilliod of St. Prex.

III. LACUSTRINE SETTLEMENTS ON THE VAUDOIS BANK OF THE LAKE OF GENEVA.

Name	Age	Explorers
Station of Vevey	?	Troyon.
„ Cully	?	Troyon, Carrard.
„ La Pierre de Cour sous Lausanne	Bronze	Carrard.
Station of Du Flon	Bronze	Carrard.
„ De la Venoge	? (pottery)	Carrard.
„ Des Roseaux de Morges	Stone and bronze	Carrard, Monod, Forel.
Station of De l'Eglise de Morges	Stone	Monod, Forel.
Station of 'Great City of Morges'	Bronze	Troyon, Morlot, Carrard, Monod, Forel.
Station of De la Poudrière de Morges	? (pottery)	Forel.
Station of Fraidaigues	Stone	Revilliod, Forel.
„ St. Prex	? (pottery)	Revilliod.
„ Rolle	Bronze	Troyon, Monod, Revilliod, Forel.
„ Promenthoux	Stone	Fauconnet.
„ Nyon	Bronze	Fauconnet, Revilliod.

With respect to the lake settlements on the Savoy side of the Lake of Geneva, I would refer to the excellent report published by M. L. Revon, of Annecy, in the 'Revue Savoisienne' du 3 Juillet, 1875, xvi^{me} année, p. 57.

IV. CEMETERIES OF THE LACUSTRINE AGE.

We will close this report on the lake dwellings of the Vaudois bank of the Lake of Geneva, by mentioning two interesting discoveries which are closely connected with them. We refer to two cemeteries, probably belonging to the lake dwellings in the neighbourhood of Morges.

In the first place there are the tombs of Boiron described as follows by M. L. Reynier in the 'Feuille du Canton de Vaud' (tome x. p. 63), under date of the 18th March, 1823:— 'Some labourers who were making holes in which to plant trees on the little hill of "Crêt du Boiron," near Morges, discovered several tombs made of rough stone slabs, coarsely worked, near this place; some skeletons were found at a small depth, one of which had two bracelets still adhering to the bones.'

These bracelets, which at the present time are in the cantonal museum of Lausanne, belong most decidedly, by their fine workmanship, rich and very characteristic ornamentation, to the '*bel âge du bronze*,' in fact to the age of the 'Great City of Morges.' The account given by M. Reynier, though unfortunately too short, confirms this opinion, as it shows a striking analogy between these tombs of Boiron, and that discovered at Auvernier, in January, 1876. The position of the Crêt du Boiron is, moreover, such that it might quite easily have answered as a cemetery for the inhabitants of the lake dwelling, either at La Poudrière, near Morges, or of Fraidaigues, near St. Prex. I made excavations in 1863, in the locality indicated by M. Reynier, on the third lake terrace of Boiron, but found nothing.

The type of the tombs at the *Moraine*, near St. Prex, is a little different. The following details I received from the proprietor, M. A. Revilliod de Muralt:—'In digging up a garden on the edge of the terrace cliff, overlooking the lake, the labourers, in the year 1865, found, about 4 feet deep, thirty skeletons simply laid in the earth; some few of them had a slab of rough stone 2 or 3 feet in length, partially covering them, and stretched horizontally over the body. The ornaments found with these skeletons belong most decidedly to the "*bel âge du bronze*," and consist of about twenty bracelets, hairpins, rings, &c. Between these skeletons, and, as far as M. Revilliod could ascertain, alternating with them quite regularly and at the same depth, there were urns, one of which has been preserved; and it also has all the characters of the pottery of the bronze age lake dwellings. This urn, which is 5 inches high, and about 6¼ inches in diameter, was filled, like all the others, with a blackish homogeneous mass, believed by M. Revilliod to have been ashes (but yet amongst these so-called ashes he did not notice the remains of any burnt bones). While the skeletons lay in trenches hollowed out of the virgin soil, or that which had been undisturbed, the urns, on the contrary, were surrounded by a considerable bed of blackish earth, containing ashes and charcoal, and showing evident traces of hearths. At the time these facts were interpreted by M. Revilliod, and those who were present at the discovery, as exhibiting the simultaneous use of two modes of burial, some bodies having been simply interred, while others were burnt and their ashes collected and placed in the urns at the very centre of the fire-place.'

This opinion has, without doubt, a certain value, but it seems to us that it is open to the following objections. The hypothesis of a double mode of sepulture, differing according to the sexes, the races, the casts, or the religious sects of the deceased, is difficult to admit amongst people so homogeneous as the inhabitants of our lake dwellings seem to have been. And even if we admit this double usage, it is still difficult to believe that the remains of those who, while living, were so unlike in opinions, habits, and prejudices, as even to call for a different mode of burial, would be found in the same cemetery.[1] Lastly, even the regularity mentioned by M. Revilliod —the almost constant alternation of skeletons with urns, could, on this supposition, only have happened by a very singular chance; for we must take into account the probable irregularity there would be in the decease of men and women, whose bodies, after death, were destined one to be buried and the other burned. If these objections are of any weight we shall be led to suppose that both the hearths and urns indicate religious ceremonies, and are the traces of funeral feasts, or of sacrifices offered in the same cemetery to the manes of the deceased, or to the infernal deities.

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[1] Possibly the incineration might be reserved for men and the interment for women. This seems to be indicated by the fact that all the ornaments found with the skeletons probably belonged to the dress of women, and that not a single weapon was found.

Nevertheless, the description given by M. Revilliod of the contents of one of those urns, being 'filled, like all the others, with a blackish homogeneous mass,' *without any burnt bones*, is opposed to the idea of their having been cinerary urns, and rather favours the theory of offerings to the dead.—[Tr.]

LACUSTRINE CEMETERY AT MONTREUX.

BY PROFESSOR RODE.[1]

NEAR the quay at Montreux, and behind the Hôtel du Port, there are some vineyards, which have lately been turned into building ground, and here skeletons and other remains have been frequently found. In August 1876 the superintendent of the works noticed a slab of limestone, about five feet below the surface, in a bed of gravel. He took every precaution when it was removed, and all that was below was taken up by hand. A skeleton was found there, but most of the bones were broken; the skull was the only part which remained in tolerable preservation. The age of the individual interred was shown by the fact that the eye tooth had not been, as the term is, entirely cut. The body was laid on its face; the limbs were extended, so that the slab only partially covered them; there were no upright slabs at the sides; nor was there one underneath the body. These facts seem to indicate a lower degree of civilisation than that of the race buried at Auvernier. On the right side, nearly under the shoulder of the skeleton, there was a small earthenware vessel, roughly made. The diameter at the top was nearly two inches and a half, the base about three quarters of an inch, and the height an inch and a half. The sides varied in thickness from one-tenth to one-fifth of an inch, being thinner above and thicker below, where the vessel had been most exposed to the fire. Fine lines had been traced very regularly upon it. We may further mention that neither this vase, nor the one we are about to describe, contained anything at all, and that neither ashes nor anything else could be seen near it. But in the tomb a bronze armilla was found, and also a bronze pin, about nine inches and a quarter long, covered all over with green patina; the head was formed of a globular portion, surmounted by a cone, standing on its apex. The top or upper part of the cone is quite flat.

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[1] These particulars were received from Dr. Keller, to whom Professor Rodo had sent a letter giving an account of the discovery. The above notice is an epitome of Professor Rode's communication. Dr. Keller remarks in his letter to me, 'It is not actually known that there was a lake dwelling at Montreux, but the antiquities are without any doubt lacustrine (volkommen lacustrisch).'

The sketches of the armlets which Dr. Keller was kind enough to send me are very nearly identical with some of those from Möringen and Auvernier figured in the present volume, and the same remark may be made as to an earthenware vessel which very much resembles some from the lake of Morat.—[TR.]

Near this skeleton several parts of a much larger skull were found, and the remains of a large massive earthenware vessel. The clay from which it was made resembled that of the other, and, like it, it was also imperfectly burnt, possibly only dried in the sun. Within it was found a large stone, which nearly filled up the whole interior.

Some days later, behind the 'Hôtel du Port,' a fresh tomb was found, containing a vessel, nearly 8 inches high and 4 inches where broadest. It is tastefully ornamented with horizontal parallel lines, between which are geometric figures. Only the base was perfect, but the fragments were carefully joined together, so as nearly to restore it. Numbers of boars' tusks were found with it, and also a horse's tooth, much smaller than those of our modern horse. No weapon of any kind was noticed, but a bronze hairpin was found, with the head as large as a nut, and with the point made very sharp.

In the year 1877 a new series of skeletons came to light, but without any covering or any kind of slabs above them; they were only protected by a kind of low wall made of pebbles heaped together, but without any cement. The place is very near where the tombs were found in 1876, but rather behind them, which leads us to imagine that the tombs last discovered are older. There were six skeletons in a narrow space of from 20 to 22 feet, and the bodies had been laid in a line parallel to the lake, while in those found the previous year the feet pointed to the lake (the south), and the heads towards the mountain. Professor Pache, who was present when one of these skeletons was found, describes it as follows:—It was laid on its right side, bent up on itself, the left arm also bent, so that the hand nearly touched the head, the back was turned to the lake and the face to the rising sun. The jaw is so perfect that any one might envy such excellent teeth. Near to it, and probably belonging to the deceased, there was a very beautiful bronze armilla, longer but narrower than that found in 1876, and two vases. One of them, rather singularly, was enclosed within the other; the interior one, though very carefully handled, fell to pieces on exposure to the air, and could not be restored. Both these vessels were ornamented with geometric figures, and this was also the case with a third vessel found here. The other relics were a pin very much decayed; flints made into wedges or knives, but not hafted; a stag's horn, and a small stone crescent.

EXCAVATIONS AT THE LAKE OF BALDEGG, NEAR LUCERNE.[1]

BY PROFESSOR AMREIN.

IN the year 1871 the proprietors of the land round this lake reduced the level of it two and a half or three feet. In consequence of this several indications of a lake settlement came to light near the outlet of the Aal river. These consisted of charcoal, hazel-nut shells, flint chips, bones, a wild boar's tusk, and also scattered piles extending two or three hundred paces along the shore, and ten or fifteen paces broad.

In all probability, at the time of the lake dwellings, the water extended to the small moraine bank on which the 'Burg' Reichensee is placed. The shell-marl is found very generally under a bed of peat earth, from 3 to 5 feet deep; and judging from the facts which have come to light here, it appears that the formation of the peat did not begin much before the age of the lake dwellings.

At the present day the margin of the tongue of land formed by the retreat of the water and the deposits on the lake bottom on the eastern shore of the ancient bay, extends nearly in a semicircular form to the river Aal, the outlet of the lake, and remains of piles may be seen there almost continuously.

To the east and north-east the settlement came within a few feet of the shore. On the north-east of the present tongue of land the sudden depth of water limited the breadth to about 15 or 20 feet, but it became gradually wider towards the west. In one place, where the shore has a decided bend, there are no traces of piles for a space of 40 or 50 feet; and then again, further west, in the middle of the tongue of land and about the middle of the settlement, it appears to have been 400 or 500 feet wide as it extended to the land on the sloping shore. After this there is a great space without piles, and then again a few piles appear at Altbach.

The upper bed, which before the lowering of the lake was covered with water, consists of gravel and the early growth of peat arising from the constant decay of water plants.

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[1] The paper from which the above account is taken, appeared in the 'Geschichtsfreund,' Band XXIX.

A few paces from the shore there is a bed of rubbish which has lain there since the last attempt, twenty years ago, to lower the lake, and from hence to some distance inland the piles may be seen here and there. Both in the water and on land the piles are very frequently placed in such a way that four thicker piles form a rectangle 6 or 8 feet broad and 10 or 12 feet long.

In an excavation of 30 or 40 square feet, made with some difficulty on account of the tough and matted roots of water plants, the upper part of the piles were seen burnt here and there; but whether this was the case or not, charcoal was found, and, at a depth of one or two feet, nutshells, pottery, flint chips, and in one place burnt wheat. Here also was found a singular little cup, made of stag's horn, and also a few implements. The piles were more numerous at a depth of 2 or 3 feet, and still more so as we approached the lake bottom, and reached a depth of 7 or 8 feet. Most of the piles were not quite upright, but had a slight inclination to the west. Occasionally, about 4 or 5 feet deep, there was a regular bed of charcoal, but implements made by human hands were scarce. This charcoal bed rested usually, but not always, on a bed of loam from 5 to 10 inches thick, and if this bed were cut through, the water from the lake, which was at a higher level, came into the excavation and made further progress very difficult, as the water had to be pumped or baled out before digging deeper. When the lower beds were reached they were found to be of a blackish brown colour, with many decayed roots of reeds and water plants, and also a few pebbles mixed with earth; and in these beds were found nutshells, pottery, and, though rarely, a few damaged implements. The first bed of charcoal was about 7 or 8 feet deep, sometimes there was a second bed, and even a third below, each bed having usually a bed of loam beneath it from five to ten inches thick. In those cases where there were several beds of loam and charcoal, both older and newer piles could very distinctly be remarked. Those of the upper bed or platform were in much better preservation, and did not go down so deep into the lake bottom, or rather into the white lake-marl, formed of the remains of shells, and called 'Alb.' These piles were easily drawn up when we were working amongst the shell-marl. The piles from the lower beds were for the most part spongy, often penetrated by the roots of water plants; and if they went below the lake-marl could neither be dug out nor drawn out, so deeply had they been driven into the lake bottom. The piles in general are of young fir, alder, birch, and oak. One oaken pile, which still projected above the lake bottom, was drawn up, and was in good preservation; of course it was pointed at the bottom. The birch piles were the most spongy, and next to them those of fir. None of the piles which were dug up were burnt below, but they were sharpened, and in some cases with a number of facets, so that some implement must have been used for the purpose.

Horizontal beams were seldom met with, but once we found three at a depth of 5 or 6 feet; they were about 3 inches in diameter, and the ends were made to fit each other, so that when placed together they formed the half of a hexagon; but, most singularly, the other three piles were not to be found.

Where the beds were more numerous but few implements were found. We often worked for a whole day without finding any. There was no positive 'relic bed,' scattered specimens were found at all depths from one to ten feet. And yet the beds containing the largest number of antiquities, and which were of a dark brown colour, occurred above the lowest pavement or platform, or on and in the shell-marl itself. As an instance of the latter we may mention some beautiful specimens of bone pointers and serpentine chisels which were found in the marl at a depth of 8 or 10 feet.

It was remarked both at Niederwyl and Wauwyl that the implements were rarely found on the platforms of the huts, but rather in a kind of passage between them; and this was the case also at Baldegg. We very often met with beds of charcoal or clay in our excavations between the piles, but in general from the surface down to the lake bottom it was always the same, viz., a dark brown earth mixed with pebbles and decayed roots of water plants. If we dug deeper, broken pottery and remains of feasts were found, and the smell of sulphur and ammonia was very strong, and yet the labourers were always glad to perceive these 'good signs,' for they knew by experience that something was to be got below, and that the excavation would not be made in vain.

In fact, in such situations amongst other refuse were found bones, nutshells, pottery, pointers or stone celts, and chisels, chiefly lying upon the shell-marl.

Unfortunately the water from the lake came in so much that we were obliged to reduce the size of our excavations. The first day we usually dug a hole down to the level of the lake, or from 3 to 5 feet deep. On the second day we began to dig out the lower beds in succession, one labourer digging and the other baling out the water; the soil thrown out was carefully turned over either by a third labourer or by myself, partly by the hands alone. When this hole had been examined as far as possible, another was dug just so far from it as to prevent the water from one penetrating into the other; and when this new opening had been examined the intermediate space was dug out and looked over as carefully as the water would allow. In this manner two-thirds of the settlement were investigated by a series of contiguous diggings.

There was much less trouble with the excavations further inland, as no water came in, and the upper beds were not of gravel and matted roots, but of black peaty earth, rolled roots, and weeds pressed together into a compact mass. The shell-marl here was nowhere so deep as on the shore; it rose gradually from 8 feet below the surface to one foot. But there were many difficulties with the farmer, who was afraid of his land being damaged. But these were got over, and a considerable excavation was made about 20 feet distant from the lake. In this excavation, which was 20 feet long by 12 broad, a number of piles were found 4 or 5 inches in diameter and 3 or 4 feet apart. A short distance below the surface charcoal was found, and a little deeper pottery, and occasionally flint flakes were dug up, which were lying amongst the piles. About 6 or 7 feet down we came upon a bed of clay, on which, amongst other things of less importance we found a celt of granite, and a very beautiful stone chisel of a grass-green colour, the cutting edge of which was translucent, and would scratch glass. On both sides of the excavation the piles stood in rows, and apparently marked out the limits of a hut. Nearly in the middle of the space we came upon a stone about 2 feet long and 1½ foot broad, somewhat worn in the middle; this stone was about 2 feet above the bed of clay, and was surrounded by a mass of charcoal; this was evidently the fireplace. When we had dug further down, the stone was found to rest on six or seven piles, 2 or 3 inches in diameter, driven into the shell-marl through the bed of clay. This latter covered two-thirds of the whole space excavated, and was about 8 or 9 feet deep. The space between these piles was filled with clay, so that the hearthstone rested on a solid foundation. No horizontal piles nor any wattlework were found, but on the contrary a large quantity of pottery and hazel-nuts. Two small pieces of *untanned* hide were found here.

The shell-marl was here about 8 or 9 feet deep; charcoal was found scattered both on it and in it; also several good bone pointers and pieces of stag's horn worked with flint.

The most interesting things were found in some small openings made in the modern tongue of land in the middle of the extreme point where there is a slight depression, hardly observable. Here, at a depth of six feet on a bed of clay was found a second bone cup, and close to it there was a very beautiful stone celt made out of a hard pebble. In the next opening a large mass of nutshells pressed together lay on the ancient lake-bottom. It was here also that we found a piece of wood which was at once recognised by one of the labourers who had been a shoemaker, as a last, and in fact it had quite the appearance of a wooden last, rather sharp-pointed both before and behind. No hollow was observable in the sole. As usual, as it dried it fell in pieces. Part of a second last, however, was found near it, and this was of stone. It had the exact form of the front part of the left foot, according to our notions indicating small feet. It is very possible that some doubt may be felt as to the determination of these two specimens, but still the fact of the settlers having made far greater advances in manufactures than that of shoemaking, and the fact also that here and elsewhere pieces of actual leather were found, as well as an actual last at Robenhausen (see Plate XII. fig. 10), seem to render the determination at least highly probable.

Fragments of polished perforated stone hammers were found, but not a single perfect specimen.

The whole of the specimens found consisted of 66 bone implements, 6 wooden implements, and 140 stone implements. In a subsequent excavation one or two beams were found lying horizontally on the stratum of shell-marl burnt on the upper side, and also a few cross timbers somewhat higher, but not in very regular order.

In several openings made in the tongue of land, underneath the decayed reeds and marsh plants, there was found a compact yellowish bed from one to two inches thick, with a very pungent smell: when closely examined, it contained animal remains, nothing else was found here except two fragments of a wooden handle, probably of a club. In some places the upright piles were only 2 or 3 feet apart, while in other cases the piles forming the common rectangles, 6 or 8 feet by 10 or 12, were thicker and made of oak.

The further we went from the lake, the nearer to the surface was the shell-marl. To the north-east, where the tongue of land joins the mainland, it is only covered with from 5 to 10 inches of peat earth, and yet in this covering there were found piles, charcoal, and flint chips, but no implements or nutshells.

Although these details may vary in some measure, yet a careful examination of the situation of the piles gives the following results. For the most part they are placed 2 or 3 feet apart, but in a space of about 10 or 12 feet long, by 6 or 8 feet broad; there seems in general to have been one main pile which reaches to the upper surface of the ground, while the intermediate ones are only found at depths of 2, 3, or 4 feet. The places also where the antiquities are found differ exceedingly, for scattered refuse and implements exist at all depths from 1 to 10 feet. It is, moreover, remarkable that throughout the whole settlement a thin bed of charcoal is seen spreading over the shell-marl. Most of the best implements, and both these and also the bed of charcoal, often lay beneath the bed of clay. It must not be forgotten that here and there one two, and three beds (or platforms) of clay are seen, and that evidently newer piles, and in a better state of preservation, occur together with those which are spongy and penetrated with the roots of water plants, and that the newer piles rise higher, and are driven to a less depth than those which are spongy.

There can be no doubt, from the above facts, that this settlement belongs to the class of lake dwellings called fascine dwellings; as a whole all the characters are the same. Most certainly the regularity in the succession of beds is wanting here, at least such as is found at Niederwyl and Wauwyl, as are also the parallel floors of timber lying horizontally. But from the repetition of three or four several beds of clay, of charcoal, and of relic beds, and also from the fact of there being both old and new piles, it is evident either that the whole structure had sunk, or that the level of the water had risen and thus rendered the formation of new platforms necessary. It only remains then to explain why a bed of charcoal with some of the best implements should have been found *below* the *lowest* bed of clay.

If we had not found in all our excavations the very same specimens under several of the hut platforms, in and upon the lake-bottom, we might have imagined that they had by chance fallen into the above-mentioned spaces between the huts, but we believe the most natural explanation to be this: that before the formation of the fascine dwelling there had been on this very spot a regular pile dwelling—this view is in some measure borne out by the large number of piles found there. This pile dwelling, like so many others, had probably been destroyed by fire, and the implements and charcoal had thus fallen on the bottom of the lake. It is a curious fact that amongst the implements found on the bottom is a bone chisel which has been calcined and become partly white and partly of a violet colour.

As at that time the water was only a few feet deep the erection of a fascine dwelling would be an easy matter: and if this view be correct, the smaller piles two or three feet apart would have kept the structure together, and the larger piles at a greater distance from each other would have formed the supports for the framework of the huts.

It ought, perhaps, also to be mentioned, that the Lake of Baldegg is considerably larger than any other lake in which fascine structures have been erected, so that the view that fascine dwellings were only made in what are called 'peat lakes' seems to be erroneous.

NOTICE OF A LAKE DWELLING AT HAMENLACHEN, NEAR BERG, IN THE CANTON OF THURGAU.[1]

THE first intimation of the existence of a lake dwelling at Heimenlachen (called in the dialect of Thurgau 'Hamenlachen') was received a few years ago by the Rev. Dean Pupikofer, of Frauenfeld. Two stone celts were sent to him as a proof of its existence, and he at once sent a person versed in these antiquities to the place, but his report seemed to be unfavourable, and consequently nothing further was done at the time.

The little village of Heimenlachen lies about a quarter of an hour's walk from Berg, on the ridge between the river Thur and the Lake of Constance. The peat moor covers nearly fifteen acres, and is in the shape of a long trough, the edges of which are only a few feet higher than the moor. The settlement found in this moor is the most easterly of all the Swiss lake dwellings.

Mr. Burkhard Raeber, Stud. Pharm. of Weinfelden, has sent the following interesting particulars respecting this settlement.

On the left of the Constance road leading to Heimenlachen, there is rather an extensive peat moor which adjoins the road. My excursion was botanical, but I could not resist picking up specimens which seemed to indicate very clearly the existence of a lake dwelling in this moor.

It may perhaps be well to state that whatever has been discovered was not brought to light by any scientific excavation, but simply during the process of digging for peat, so that it is quite impossible to give any definite idea of the extent of the settlement.

But in any case the number of huts cannot have been small, for in one place more than a hundred decayed piles were dug up. From their upright position it appears that this settlement was one of the regular pile dwellings, and very different from the fascine dwelling of Niederwyl, near Frauenfeld. The settlement at Heimenlachen is much more like that of Moosseedorf which was also situated in a marsh lake.

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[1] 'Anzeiger,' No. 3, 1870.

A splendid skull of the Urus, with both horns, was dug up here about ten years ago, and was lying about on the moor for a length of time, till at length it was thrown aside as a useless thing and was buried in a rubbish heap of sods and peat earth. Nearly at the same time the perfect antler of a stag was also dug up, now in the museum of St. Gall. Stone celts are to be found in the possession of the neighbouring cottagers: they go by the name of 'heathen axes,' and are given to the children as playthings. A few days ago two very pretty celts of serpentine were found by the scholars here, and are now in the possession of the schoolmaster: one of them is remarkably well wrought, the edge is so sharp that a lead pencil might be cut with it. In my own collection I have the following specimens:—

1. A celt of hornblende.
2. Several fragments of hammers of a grey kind of stone.
3. A chisel of serpentine.
4. A corn-crusher.
5. A cylindrical piece of serpentine perforated. In this specimen when the round boring tool had got half through, it was turned to begin again on the other side, but in this case the boring did not come out correctly by two or three lines, so that the holes do not meet.
6. A number of pieces of pottery, some of which were fragments of large vessels made of clay mixed with quartz grains, and mica, and others were portions of small vessels made of purified clay, and smoothed outside.
7. A piece of clay and moss kneaded together, most probably a piece of the clay covering of the basket-work walls of the huts.
8. A piece of sandstone ground down on one side.
9. Several fragments of hornblende rock: these seem to be a proof that the settlers made their stone tools on the spot.
10. A piece of a large serpentine hammer.

Pieces of piles, of basketwork, or rather of wattlework, and of pottery are lying about. Though I spent a long time in searching, I was not able to find a single specimen of bronze, and I am convinced that this lake dwelling belongs to the stone age, and that it was abandoned before the beginning of the bronze age.

The present peat moor was probably in ancient times a small lake, having its outlet at Totnach, which in fact is the case at the present day in very wet weather. But in the course of thousands of years this basin was filled up with successive layers composed of the accumulated remains of water plants, and of wood which had floated down, thus forming a bed of peat many feet in thickness covering the remains of human industry.

We understand from an antiquary who has visited the place since the above report was made that all the implements found here, whether of bone, horn, or flint, agree exactly with those from Niederwyl. They give a tolerably perfect representation of the objects found in a settlement of the stone age.

Subsequently, Mr. B. Raeber sent a further report on this lake dwelling. It appeared in the 'Anzeiger' for 1871, No. 107, page 286. The substance of it will now be given:—

To complete my report as to this settlement I now beg to send my account of later discoveries.

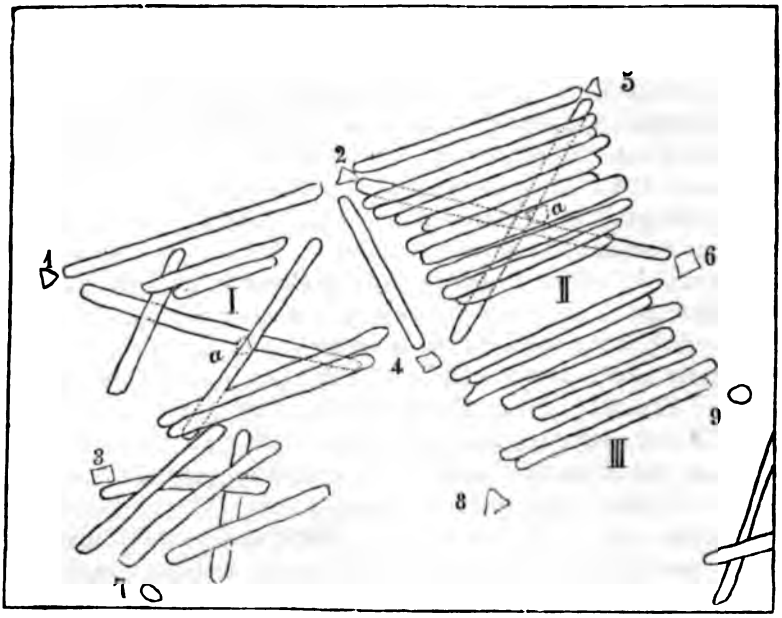
In the first place I endeavoured to throw some light on the arrangement of the piles by having a rectangle of 16 feet by 14 carefully excavated. This opening was to the right of that originally made in the middle of the peat, and rather to the north. The following is the succession of the beds:—

1. A bed of loamy earth grown over with high grass—2 feet.
2. A bed of arable earth, sand, and clay, very much intermixed—about 1 foot—passing into
3. The relic bed, composed of black and marshy matter, with a good deal of charcoal, pieces of wood, and the remains of domestic economy: in fact, this is the actual bed wherein the specimens are found: it is sometimes higher and sometimes lower in position. The piles are driven down into this bed, and although from 8 to 10 feet long do not in any case go through the subjacent bed—1 foot to 1½ foot.
4. A bed consisting entirely of peat sometimes fifteen feet thick. The turf cutter often goes so deep that the tops of the piles are above his head. From this fact it seems clear that peat must have begun to be formed in the lake of Heimenlachen, when the wandering tribes began to erect their abodes, till by its continued increase they were deprived of the water which was their means of safety, and were thus compelled to seek for more secure localities.
5. Fine potter's clay, probably used, when mixed with quartz sand, by the settlers for their earthenware.
6. Sand and alluvial gravel—from 1 to 2 feet.

The succession of these beds naturally varies. For instance, on the east side of the moor the bed of peat is only five feet thick, and under it there is a bed of what is called white shell-marl from 2 to 4 feet thick, containing an infinity of small shells. I cunted six very decidedly different forms.

The subjoined woodcut is a plan of the piles and boards which came to light in this excavation:—

Fig. 26.



The main piles 1, 2, 3, 4, form a somewhat irregular quadrangle—and so do also 2, 4, 5, and 6, and yet it is easy to see that everything agrees together. Both of these quadrilaterals have in their centre a strong pile (*a*, *a*,) supporting the beams of the platform which were placed diagonally beneath the flooring, as may be easily seen in the diagram fig. 27.

Of the other supporting piles only No. 8 is to be seen, although they ought to have stood near where 7 and 9 stand. In the square formed by Nos. 2, 5, 4, and 6, nearly the whole platform was still found consisting of boards, 2 inches thick, and from 5 to 8 inches broad—young fir trees must have been split for this purpose. In two of the other rectangles these split boards which formed the platform were placed in regular order. It is hardly probable that each of these rectangles can have been the platform for a single hut, as it would in that case have measured only 6 feet long by 4 feet broad; I should be more disposed to consider 1, 5, 7 and 9 to have been the corners of one of the huts, which then would have had a much larger area, and would have allowed sufficient room for a family. In order to secure the hut more firmly, strong piles were driven down in the middle at *a*, and these piles very singularly are of squared timber. Nothing trustworthy came to light as to the actual huts which were built upon the platform, nor anything like walls, but there were many indications, such as dried pieces of clay, kneaded up with moss, coverings of the wattlework walls, thick branches of trees bent zigzag, evidently derived from the same source, &c. But few tools or implements were found here. A small celt, a fragment of a hammer, and a perforated piece of burnt clay comprise the whole. The piece of clay we may imagine to be a loom weight, but this is only a supposition, for it is quite broken to pieces. Wood which has been drifted here is met with everywhere.

Some of the specimens found here shall now be very briefly noted, dividing them according to their material.

Serpentine.—Many forms of chisels and small celts, very carefully worked, and with very sharp edges. Also some of the cores which resulted from the operation of boring. The perforated tools are singularly rare, probably the reason of this is that the settlers were obliged to abandon their abode, and took with them their best tools. In some cases the boring had not been correctly made from the two sides, and the two holes from opposite sides did not meet by from half a line to two lines. The pebbles brought down by the Rhine from the Grisons gave the inhabitants plenty of stone adapted for tools, and the chips and fragments found show that they were worked on the spot.

Hornblende Rock (especially *Amphibolite* and *Diorite*).—This was made into all sorts of implements, celts, hammers, corn-crushers, polishing stones, &c.; the celts are carefully wrought; some of the stones were found with incisions in the process of being manufactured into celts.

But little flint was found here.

White Quartz.—A number of small stones of white quartz were met with everywhere in this settlement, probably intended to be broken small and then mixed with the clay for the potter's use.

Sandstone was used for polishing stones.

Clay slate and mica slate were found here, probably intended to be worked into tools.

The pottery must have been of a very primitive kind. Numerous fragments are found, all made of clay, mixed with white quartz-sand. The vessels appear not to have been burnt in a regular oven, but first dried in the sun and then burnt in an open fire.

I found no implements either of horn, bone, or wood, and, as before mentioned, not a trace of metal. All the specimens found at Heimenlachen are now in the Cantonal museum at Frauenfeld.

These lake settlements in the small marsh lakes are very remarkable. Some are fascine structures like Niederwyl, and the settlement adjoins the shore; others, like Heimenlachen, are regular pile dwellings. If the question be asked why settlements of this kind were erected in such small sheets of water, it will be difficult to give a satisfactory answer, either on account of subsistence or security. For as these lakes are only twenty or thirty feet deep, they are frozen over every winter in December and January, so that at that time the position of the settlements afforded no protection, neither could there have been any when built close to the shore; and with respect to subsistence the fish in these small lakes are comparatively few and small, and the fresh-water mussels, though very plentiful, do not seem to have been eaten by the colonists.

And yet these small settlements were not behind others in civilisation, for they knew what nephrite was; they could bore stone celts; they could weave and make good pottery. No bronze has yet been found in these small colonies.[1]

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[1] Communicated by letter from Dr. Keller.—[Tr.]

LAKE OF BOURGET IN SAVOY.

We are indebted to Baron Despine, one of the most active members of the Historical and Archæological Society of Savoy, for the discovery of a lake dwelling in the lake of Bourget. At the meeting of this Society on September 2, 1857, Baron Despine announced that he had observed a great number of piles on the eastern shore of the lake in the Bay of Grésine-Saint-Innocent, lying north of Aix, which probably were the remains of an ancient lake dwelling. As on a closer examination numerous fragments of pottery confirmed this supposition, the Baron sent a communication to the French Academy on the discovery of this settlement in the Lake of Bourget, probably belonging to the stone period ('Patrie,' June 30, 1862).

On July 10, 1862, the above-mentioned Society met together for the purpose of arranging the ways and means for a complete investigation of the settlements in this lake, and appointed a commission to carry on operations in the Bay of Grésine. On July 29, M. Rabut Laurent, a member of the commission, communicated the following report in the 'Bulletin de la Société Savoisienne d'Histoire et d'Archéologie,' 1861–2, No. ii. p. 44.

'The commission began its labours under the direction of the Baron Despine, and M. Charles Delaborde. It recognised traces of habitations in the shape of piles or stakes driven into the whitish clay on an area of about 24,000 square yards, about 220 yards from the shore, and at a depth varying from 6 to 8 feet. The distance between the piles varies a good deal; they are mostly a yard apart, but are frequently interrupted; other pieces of wood are laid across, and remains of pottery might be seen lying about on the bottom of the lake. We set to work to dredge them up, and in a short time filled two boats with fragments of vessels of different forms and sizes.

'The largest of them have a considerable bulge, and are made of red, grey, or black clay, coarsely worked and mixed with small siliceous pebbles. Some vessels made of a finer material exhibit small plates of mica. They are often covered with ornaments engraved with a point like the Greek pottery

(Plate CVI. fig. 1). Others are more simple and widely spread out, and the opening is very broad. Very few are found with handles. Many of these vessels are partially filled with a kind of textile fibre, compact and rather red, but becoming black by exposure to the air.

'Traces of conflagration are found everywhere among these remains: the pieces of wood are half burned; the fruits found at the bottoms of the vessels are carbonised, and to this circumstance doubtless we owe their preservation: the vessels themselves have their sides blackened by the action of fire. Ears of barley, acorns, nutshells, rinds of chestnuts, cherry-stones, and grains of millet have been well preserved.

'Amongst the more perfect objects may be mentioned a circlet or ring of earthenware used for the support of those vessels which have a conical base (fig. 7); a spindle-whorl found by M. Delaborde (fig. 6); a piercer of very hard wood, well made and polished, but which has lost its original shape by exposure to the air; calcined bones, a stone hammer, and a small bronze ring.

'Can it be concluded from this last specimen having been found here that the settlement was of the bronze age? It is difficult to reply. It may be as well here to mention that several antiquities of the stone age have been found in Savoy, and two may be especially mentioned, now in the collection of Dr. Davat, one a flint knife of a whitish tint found at Hautecombe, and the other a fine hatchet or stone celt made of siliceous stone of a rather dark green colour, nearly 14 inches long, found at Chéran.

'The collection of Baron Despine contains a vessel of a very curious shape, which was dredged up by M. Delaborde, and which I have drawn fig. 3, though it does not form part of the collection made by the commission. It has the form of a teapot, is very narrow at the opening, and very wide at the base, and is supported by four short rounded feet. On one side it has the remains of a handle, and on the other a little opening closed by a plug of wood charred on the outside. This opening is made near the bottom of the vessel to allow the liquid to flow out. Other specimens of pottery are drawn, figs. 2, 4, 5, 8, and 9. Fig. 2 is probably a vessel for making cheese; fig. 4 is remarkable for the rope-like ornament upon it; and fig. 5 for the ornamentation of impressed dots, resembling in some measure a fragment dug up at the Uetliberg. The specimens drawn, figs. 8 and 9, appear to be beads. All the drawings on this plate have been copied from the work of M. Rabut.

'Other lake dwellings have been mentioned to the Commission, amongst which is that of Tresserve in front of Saut de la Pucelle—Dr. Davat believes that a bronze celt in his possession was obtained here—and the station of Conjux at the entrance of the canal of Savières. The traces of dwellings there are numerous, and are well deserving of the attention of the Society.

'The settlement of Grésine was subsequently investigated by Professor Desor of Neuchâtel, but unfortunately the weather was unfavourable and the result was not very productive. One nearly perfect urn, however, was obtained, almost a foot and a half in diameter. The fine shape and the ornament on the pottery, together with the general use of graphite, made M. Desor conclude that they belonged to the bronze period, a supposition which is supported by the appearance of the piles, and the considerable depth at which they were found. It is striking that hardly any bronze implements have been found in this locality, although the surrounding district has yielded a large number. Dr. Davat's collection contains bronze celts, sickles, and hairpins, all from this neighbourhood.'

Supplement to the Report on the Lake of Bourget.

The above report contains the substance of what was known of the pile dwellings in this lake up to 1866, the year when the first edition of this work was published. Since then several valuable papers have appeared giving an account of more recent discoveries. Amongst them may be mentioned 'Étude prehistorique sur la Savoie, specialement a l'époque lacustre (Âge du Bronze), par André Perrin-Chambery, 1870. A second little work was also published the same year by Count Costa de Beauregard, 'Habitations lacustres du lac du Bourget:' Paris, 1870. And a third book has just appeared by the first-named author, André Perrin, 'Palafittes du Bassin du Rhône, Âge du Bronze,' in which his name is associated with that of M. Ernest Chautre. This of course contains the latest information. From these three works the following supplementary account of the pile dwellings of the Lake of Bourget has been derived; in one or two cases some additional matter of interest has been inserted from the original work of M. Rabut, which was inadvertently omitted in the first edition.

Although all the specimens will be described as coming from the Lake of Bourget, it may be well to give the names of all the pile dwellings known in it up to the present time; they are eight in number: Conjux, Chatillon, two at Grésine, Meirnart, Saut de la Pucelle, Les Fiollets, and Charpignat.

1. *Conjux.*—This lake dwelling is just opposite the village of the same name. Hardly any arms were found here, but a large quantity of pottery, many of them of one type, and also moulds for making socketed knives, rings, and celts.

2. *Chatillon.*—At the north-east of the lake. The depth of the water is from 6½ to 13 feet; the settlement is nearly 500 feet distant from the shore, the pebbles or stones seen elsewhere are not so plentiful here. The piles are peculiar: they are of two kinds, some are like those of Tresserve or Saut, while others, which cover the whole side of a gentle rise in the lake bottom, project from the mud from 30 to above 40 inches, and are inclined to the east at an angle of about 45 degrees. These latter piles are longer and in a better state of preservation than the others, and apparently are of more recent date. The fire seems to have spared this part of the settlement. Possibly the inclination may have been caused by one of the great hurricanes from the west, which are very destructive in this district. It is singular that an earthenware vessel, found amongst these inclined piles, is very like the later productions of the lake-dwelling pottery, but it bears a *Roman* name as the maker, SEVERINUS. F. Is it possible that some of the ancient inhabitants continued to live here till Roman times? At this place, however, pottery and earthenware vessels of a primitive character were found, and others which rather seem to resemble those of the Gallo-Roman period.

3 & 4. *Grésine* is a station a little higher up the lake than Saut de la Pucelle, on the eastern shore; it is of considerable extent, and is rich in antiquities. It has two rises or 'steinbergs' nearly joining together, and apparently made of stones; one is about 60 feet from the shore, the other comes very near the railway, and is about 20 feet distant. The piles are innumerable, they project from the mud from 6 to 9 inches, and in a measure indicate the ground plan of the huts. Around these piles is found an astonishing quantity of pottery of all kinds, also stone and bronze implements, and carbonised fruits, amongst which acorns are very common. One vessel contained thirty.

5. *Meirnart.*—This settlement is about 330 feet from the shore, near the hill of St. Innocent, in front of a clump of trees, not far from the village of Meirnart. It is of considerable size,

and the piles are numerous, but it has not been much explored. The rise or 'steinberg' is deeper than the others in the lake, viz., from 16 to 20 feet under water. A few antiquities have been found here, but nothing of any great interest.

6. *Saut de la Pucelle, or Tresserve.*—This is the largest station in the lake except Grésine; it has been carefully explored, but the numerous antiquities found there do not offer any great peculiarity, except the figure of a pig in earthenware, very coarsely made, and a bone harpoon. . . . A piece of timber 22 feet long, with mortises at each end, was found here: it probably formed part of the floor of one of the huts. This settlement is on a small rise, with a quantity of stones upon it of various sizes, but all such as could be carried in the hand; the depth of water varies from 6 to 16 feet; the station is about 330 feet from the shore. The piles are numerous, and about 6 inches in diameter. The pottery found here round these piles is coarse, blackish in colour, and mixed with grains of flint; ring-supports of clay are also found here. But further in towards the lake, the piles project higher from the mud as the water is deeper, and the fragments of pottery are of a finer clay, and exhibit greater care in the manufacture; this seems to indicate an antiquity not quite so remote.

7. *Les Fiollets,* a settlement of small extent on a little rise in front of Tresserve. The water is deeper here than on any other station in the lake, so that this settlement can only be explored when the water is low.

8. *Charpignat.*—On the west bank of the lake not far from the village of Bourget, is a settlement where piles may be seen, but as yet no real investigation of them has been made.

A brief notice of some of the principal objects, found since the publication of the first edition, is given below : they have been selected from the works before mentioned.

OBJECTS OF STONE.

Plate CLIII. Fig. 1. Drawn ¼ of the full size.[1] Probably a loom weight, the right-hand view gives the section, and shows the mode of suspension.

Fig. 2. Weight with a groove round it, for the attachment of a cord or thong. It is of sandstone. (May not this have been a weapon like the South American *bolas* which are

so well described by Darwin, in his 'Voyage round the World, in H.M.S. Beagle,' pp. 44 and 111, Edit. of 1870 ?)

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[1] At the foot of Plate CLIII. it is stated that all the objects are of the full si but Fig. 1 was included by mistake. As above-mentioned it is ¼ of the full size.—[Tr.]

Figs 3 and 4. Sharpening stones or 'touchstones' perforated for suspension.

Fig. 5. Perforated spindle-whorl (?) of sandstone.

Fig. 6. Diamond-shaped necklace ornament, the perforation was never completed: in fact it had only just been begun.

Figs. 7 and 8. Flint arrow-heads.

POTTERY AND EARTHENWARE.

Plate CLI. Fig. 1. A vessel standing on four feet.

Figs. 2 and 3. Little cups of fine black ware.

Fig. 4. Ditto, with a handle.

Fig. 5. Jar of coarse clay mixed with fine siliceous sand: it is very rough outside.

Fig. 6. Little vessel of black ware.

Fig. 7. Vessel of fine black ware, with the edge expanded and ornamented with a rather rudely ribbed band running round it.

Fig. 8. Vessel of black ware, ornamented with two lines running round it, and another below them made of dots or short lines.

Fig. 9. Vessel of fine black ware, with the edges expanded: it is ornamented with two lines running round it, and three tiers of small concentric circles one above the double line, and the other two below it. The vessel had a considerable amount of bulge.

Fig. 10. Fragment of pottery ornamented with a succession of circles.

Fig. 11. Fragment of fine grey ware, divided by lines into four parts, one of which is ornamented with concentric circles.

Fig. 12. Fragment of a plate of fine black ware, ornamented with double lines, between which are chevrons.

Fig. 13. Fragment ornamented with an undulating line above two concentric lines.

Fig. 14. Fragment of reddish ware, ornamented with two double lines, between which is a row of circles, within which are points.

Fig. 15. Fragments of a plate of fine black clay, ornamented with lines and rectangular depressions.

Fig. 16. Portion of a plate of fine black ware, divided by double line crossing each other: the alternate spaces, and also

the border are ornamented with rectangular depressions, within which is a dot or point.

Plate CIX. Fig. 1. Fragment of fine grey ware, ornamented with a fillet, and with alternating hollowed squares.

Fig. 2. Bottom of a coarse vessel, with impressions of ferns.

Fig. 3. Bottom of a vessel of coarse red ware, covered with a coating of a kind of cement, to which are fixed small bands of tin crossing each other.

Fig. 4. Fragment of the edge of a plate of fine black ware, with a chevron pattern made of bands of thin tin.

Fig. 5. Fragment of grey earthenware, ornamented with alternating hollow squares.

Fig. 6. Fragment ornamented with chevrons of thin tin, fixed with cement.

Fig. 7. Fragment of black ware, ornamented with lines.

Fig. 8. Small fragment, ornamented with tin bands.

Plate CLII. Fig. 1. Lamp of fine black ware, on four feet; probably the two projections behind were part of the handle.

Fig. 2. Upper part of a lamp, coarsely made, ornamented with two concentric lines.

Fig. 3. Fragment of a lamp of coarse red ware, the opening is expanded at the top.

Fig. 4. Black pottery, coloured red, with rectangular black ornamentations.

Fig. 5. Fragment of a plate, coloured red, and ornamented with black lines, forming squares, some of which are filled with diagonal lines.

Fig. 6. Part of a broken plate, of fine ware, coloured red, covered with a pattern of black lines forming squares, angles, and rings.

Fig. 7. Part of a plate, coloured red, and ornamented with black lines, chequers, and chevrons.

Fig. 8. Pottery, coloured red, and ornamented with black chevron lines.

Plate CLVIII. Fig. 1. Figure of some animal with a long body; it is of black hard-baked clay, but it is not sufficiently perfect to enable us to say what animal it was intended for. A second figure rather similar, but somewhat thinner, was also found here, but in this case also it was impossible to say what animal it represented.

Fig. 2. A figure very badly formed. Can it have been intended for a standing bear?[1]

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[1] Or a sow?—[Tr.]

Fig. 3. Figure, or child's plaything: several other similar ones were found.

Fig. 4. Said to be a fragment of the inside coating of one of the huts (?), having apparently concentric lines separated by the 'Greek' pattern and chevrons.

Plate CLIX. Fig. 3. Cup or vessel of a peculiar form: the side view is given at the top, and the under surface in the lower figure: within the central hollow there is a cross.

Plate CLXI. Fig. 2. Is a peculiar form of what are generally called crescents, although this term is hardly applicable to the present specimen: it is said to be drawn one half the natural size.[1]

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[1] Just before these sheets were sent to the printer I was exceedingly interested, while paying a visit to my friend Arthur Champernowne, Esq., of Dartington Hall, to find that his aunt, Miss Louisa Champernowne, had brought from the South of Africa a wooden head-rest, very similar to that of which a woodcut is given p. 178, and which came from the Somali country, so that it is very evident that the use of head-rests extends over a large portion of that continent. Mr. Champernowne writes to me that this head-rest, which like that from Somali is highly ornamented, was bought at Durban, in Natal. He says: 'They are used by the Zulus: Zululand adjoins Natal. Mrs. Williams saw one double the length for married Zulus. This is copied almost word for word, from a letter of Miss Louisa Champernowne's, which came this morning.'

I need hardly point out the bearing of this extract upon the crescent (head-rest?) drawn fig. 2, Plate CLXI. It interested me greatly, and I have to return my best thanks to that lady for allowing me to publish it.

Since the above note was written one or two other specimens of head-rests have come under my notice, which are worth mentioning, as they came from Polynesia and show a still wider extension of their use. When at Oxford, Professor Rolleston kindly showed me two specimens, and also introduced me to the Rev. S. J. Whitmee, who was then at Oxford, but is a missionary to Polynesia. This gentleman gave me a great deal of information respecting them.

The first specimen came from the Samoan Islands, and was sent to the Oxford Museum by the Rev. J. King, who was also a missionary there. It is, in fact, simply a piece of cane about 18 inches long, and 3 inches in diameter, and it has underneath two wooden supports fastened to it, carved in the shape of a reversed V—thus Λ—so as to raise it a little from the ground with some approach to stability. Mr. Whitmee assures me that they are exceedingly common, that all the natives use them, and that though the specimen in the Oxford Museum is short, being intended only for one person, yet these head-rests are frequently from 6 to 12 feet long, and in these cases they are used by a whole family.

A second specimen was formed somewhat differently, it came from what is called 'Savage Island' (or, as Mr. Whitmee informed me, the more correct name is Niuĕ Island). It is simply a piece of wood in the shape of what the smiths call 'quarter round' iron, or in other words, if a cylinder of wood, about three inches in diameter, had to be made into a square by sawing off four strips, each of the four strips so cut off would be of the form of the upper part of this head-rest. It is 17½ inches long, and below or on the flat part two little flat boards (not cut into a V or reversed Λ shape), are fastened on to it at right angles, thus forming a substitute for the expanded legs in the previous case. The head-rest is by this means raised about three inches from the ground. The upper side is ornamented with a chequer-work of incised crossed lines. At the last moment a fact has been communicated to

Fig. 3. This sketch is taken from a portion of clay which the author considers most probably belonged to the covering of the huts. This mode of ornamentation, he says, is only found in the lake dwellings of Bourget; it is not mentioned in any notice of the pile settlements in Switzerland or Italy. The specimen under consideration bears upon its surface two impressions of the *swastika* or 'croix gammée,' it is in the collection of the Duc de Chaulnes in Paris, who has taken great interest in the antiquities of the Lake of Bourget. Fig. 4 is a stamp or seal made to give this peculiar impression on the clay, and Fig. 5 is also a stamp or seal, but in this case the impression would merely form three concentric circles. Both these stamps are in the collection of the Duc de Chaulnes.[1]

OBJECTS OF BRONZE.

Plate CVII. Figs. 1 to 9. Knives of various descriptions.

Plate CVIII. Figs. 1 and 4. Unsocketed celts.

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me by Captain Charles Cooper King, of Sandhurst College, which shows how universally these head-rests are used. Captain King tells me that he has repeatedly slept on them in Japan, as they are most comfortable in hot weather. He has kindly sent me a drawing of one which almost exactly resembles those from Eastern Africa, except that it is less ornamented and has a soft pillow at the top of it. Almost precisely similar information respecting the Japanese head-rests has also been given me by Mr. J. E. Ollivant, son of the Bishop of Llandaff. (See also note p. 178.)—[Tr.]

[1] With respect to the 'croix gammée,' it would be out of place here to enter into any discussion respecting it. The reader is referred to the work of M. de Mortillet, 'Le signe de la croix avant le Christianisme.' Paris, 1866.

It may be well to state that as in M. Perrin's late work there appeared to be a trifling want of precise information as to these stamps for making the 'croix gammée' having actually been found in the Lake of Bourget, I ventured to address a letter of inquiry to the Duc de Chaulnes, and he has kindly assured me that both the stamps or seals now drawn are in his possession, and both came from Grésine on the Lake of Bourget. They will be exhibited in the French Exhibition of 1878. Something very like the 'croix gammée' is seen on several spindle-whorls, drawn by Dr. H. Schliemann in his work on Troy, plates xxv. fig. 359, xxvi. fig. 363, &c., &c. It may possibly be the case that the 'croix gammée' may be considered by some antiquaries of too great importance; it appears to have been used amongst nations separated by wide intervals both of time and space. When at Zürich, while these sheets were passing through the press, Dr. Keller showed me a photograph which had been given to him by a gentleman of St. Louis, U.S. It was the copy of a 'counter' or 'roundel,' either of bone or horn, found in one of the low mounds near St. Louis. It is about to be described in one of the journals, and therefore it would not have been right to have asked for leave to make a woodcut of it; but there can be no reason why it may not be mentioned. It is about an inch and three-quarters in diameter. Within three concentric circles there is a rude figure of a spider, or a crab, and in the centre there is a small circle, within which is *a regular 'croix gammée.'* How it came there, and at what age, must be left for antiquaries to decide; but the fact of its having been discovered in a mound in America seems to show that this peculiar figure must have been used by nations very far apart.—[Tr.]

Figs. 2 and 3. Socketed celts.

Fig. 5. Hammer with a socket.

Fig. 7. Socketed chisel, or celt.

Plate CLVIII. Fig. 6. Two bracelets or armlets, identically the same in form and ornamentation, joined together by a flat band, covered with a chevron pattern.

Fig. 7. Very short and thin knife.

Plate CLIV. Fig. 1. Clasp of an oval form, terminating at one end in a hook, and at the other in five projections broken off at the ends.

Fig. 2. Razor or cutting instrument, the handle of which is formed of two rings, ornamented on the outer side with diagonal lines, which are continued along the back of the blade.

Fig. 3. Large socketed knife, ornamented on the back with lozenges and lines, and with raised ridges running round the socket.

Fig. 4. Highly ornamented knife with a tang or spike: the two sides and the back are covered with lines of festoons and chevrons.

Fig. 5. Knife, broken into four parts: the handle is ornamented slightly, and is terminated by a ring for suspension; on each side of the blade there are two raised lines running parallel with the cutting edge.

Fig. 6. Razor ornamented with a line of chevrons between two lines of dots or points near the back. This implement is perforated for suspension.

Plate CLV. Fig. 1. Armilla made of a flat bent band of bronze, ornamented with straight and diagonal lines.

Fig. 2. Armilla made smaller at the extremities, ornamented with a few lines.

Fig. 3. Armilla of hollow bronze, covered with a series of oblique lines, alternating with another series also oblique, but at right angles to the others; this abundance of ornament is, however, only found in the front. Near the two smaller ends there are only a repeated series of four or five lines passing round the outside.

Fig. 4. Great armilla, partly open within; the two ends are rounded, and have each a projection like a button, the outside is divided by three longitudinal bands, between which there are numerous lines, some at right angles to the bands, and others in chevron.

Fig. 5. Round plate or button, perforated in the centre with a double line of small circles round the edge, the middle consists of a series of radiations, each separate ray being formed of a number of circles.

Fig. 6. Round flat plates of a clasp, stamped with concentric circles.

Fig. 7. Plate of a clasp? ornamented with lines, and two series of circles.

Fig. 8. Portion of a ring, with projecting points at regular intervals.

Fig. 9. Four rings cast together, for suspending ornaments.

Fig. 10. Chain formed of double rings joined together with bands.

Plate CLVI. Fig. 1. Part of an ornamented sickle.

Fig. 2. Socketed arrow-head.

Fig. 3. Blade of poignard or lance, with a hole for riveting it to the handle.

Fig. 4. A kind of sickle-knife, with a rib at the back, and a stud to aid in fastening the handle.

Fig. 5. Lance-head, there are two holes in it so as to secure it to the shaft by rivets.

Fig. 6. Small arrow-head, which had been bent round the shaft.

Fig. 7. Lanceolate arrow-head, to be fixed in the wood of the shaft.

Figs. 8 and 9. Arrow-heads, with two rivet holes.

Fig. 10. Arrow-head, with a stem.

Fig. 11. Ornamented arrow-head, with holes for rivets.

Plate CLVII. fig. 1. Pin with a flat head with concentric circles on it, the shank is ornamented with lines.

Fig. 2. Pin with the head formed of two circles, one within the other, joined together by four rays.

Fig. 3. Pin with a round flat head, with a pyramidal centre; beneath the head there are two or three fillets.

Fig. 4. Pin with the head originally a circle, but now broken.

Fig. 5. Pin with the head flattened, and rolled into a circle.

Fig. 6. Pin with a round head conical above; the shank is ornamented with several projecting rings.

Fig. 7. Needle with an eye, half size.

Fig. 8. Needle with the eye nearly in the middle.

Figs. 9, 10, 11, 14, 16. Bronze pointers and needles.

Figs. 12, 13, 15. Hooks without barbs.

Figs. 18 and 19. Barbed hooks.

Fig. 17. Razor in the form of a semicircle ornamented with

circles, with a central dot in each. A semicircular portion is cut out of the middle of the back.

Plate CLIX. fig. 1. This beautiful and unique bronze vase was obtained at Grésine, and is now in the collection of Count Costa; it was found in the mould in which it had been cast, but unfortunately the fishermen's curiosity led them to break the mould. The vase is nearly 2 inches high, and about 2 inches wide at the opening. Below the lip, which is much expanded, are two lines or fillets, beneath which, about the middle height of the vase, there is a double rope-like band coarsely striated diagonally. Is it not probable that so handsome a vessel as this, was used, or intended to be used, at some religious ceremony? It was found precisely at the place where numerous other valuable bronze antiquities were procured.

Plate CLIX. Figs. 2 and 4. Bronze celts: the forms are rather characteristic.

Fig. 5. A bronze arrow-head, also peculiar in form.

Plate CLXI. Fig. 1. A hollow ball of bronze with three openings, it is difficult to say to what purpose it has been applied, but it evidently has been manufactured with great care. It bears decided traces of having been ornamented by the graver after having been cast.

Fig. 7 is a bronze tube of a somewhat peculiar form.

Figs. 8 and 9 are hairpins with very large heads: which consist of flat rings intersected by rays. In the case of fig. 9, there are two rings one within the other, forming a kind of wheel-shaped ornament—the shank of both these pins is short.

Fig. 6 is a *bone* spear-head or harpoon.

LAKE DWELLINGS SOUTH OF THE ALPS.

Before giving an account of the researches of Italian antiquaries on the southern slope of the Alps and in Upper Italy, a few general remarks may not be out of place. There can now be no possible doubt that the colonists in these districts lived precisely in the same manner as their kindred races on the other side of the mountains, and that their settlements, like those of Meilen, Nidau, &c., were founded in the stone age, and continued till the beginning of the bronze period; or, to speak more correctly, that the colonists lived here for a long time without any knowledge of metals, that afterwards they became possessed of bronze implements, but that they abandoned the locality before the introduction of iron weapons.

It need not surprise us that, immediately after the discovery of the Italian pile dwellings, the question was raised whether the occurrence of such settlements south of the Alps does not warrant the inference that the immigration of the earliest population into the valleys of North Switzerland took place from the south, and not, as has hitherto been supposed, from the east. It is no doubt probable that the mild and fertile land of Italy, especially those tracts open to the navigation of the Mediterranean, and thus communicating with the earliest civilised nations, may have been inhabited sooner than the northern slopes of the Alps; and it may be also the fact that mountain ranges have been no greater hindrances to the passage of migratory tribes than dense forests and rapid rivers. This view, for which various other reasons are adduced, is, however, at present, destitute of any positive basis, and apparently can neither be affirmed nor denied. The only point which perhaps can be granted without risk is the community of race of the lake settlers on both sides of the Alps.

Another question is, whence the settlers of the lake dwellings, whether on one side of the Alps or the other, first obtained the metals, especially copper, or that metal in combination with tin. Here we meet with several views diametrically opposed to each other. According to one opinion, the inhabitants of Middle and Northern Europe, before they knew either how to obtain the metals from the ground, especially copper, or how to work them, became acquainted with these materials by barter with the inhabitants of Southern Europe, so early advanced in civilisation, and especially with Greece. This assertion rests on the fact, long since recognised as incontestible, that a number of bronze articles found in transalpine countries both in burying-places and scattered over the ground, such as arms, tools, and ornaments, bear the most striking resemblance both in form and ornamentation to the corresponding objects found in Greece, Sicily, and Lower Italy, and which may be seen (as, for instance, the swords) represented in the paintings on ancient Greek vases. If we compare the bronze implements of Upper Italy both on this side of the Po, and beyond it, and also the excellent drawings of the contents of Etruscan burying-places, published by Count Gozzadini, with those of the Swiss lake dwellings, such a similarity of form and decoration may be observed between them as, even if a common origin be not assumed, to prove indisputably a near connection between the civilisation of the founders of the lake dwellings, both cisalpine and transalpine, with the primitive inhabitants of Upper Italy. (See 'Descrizione del Conte Gozzadini di un Sepolcreto Etrusco scoperto presso Bologna,' Bologna, 1855 and 1856.) And again, as in the countries of Southern Europe a large number of bronze implements are found of a very primitive form, as, for example, the simple bronze celt copied from the stone celt, it is inferred that Northern Europe was at first supplied with bronze articles from the South, until by advancing civilisation the inhabitants succeeded in procuring and working the material, and in rudely imitating southern models. To support this view, attention is directed to the extensive commerce of the Greeks, and to their relations with the Egyptians and Phœnicians, nations early in possession of a civilisation mainly based on the use of metals.

According to another hypothesis, the tribes who migrated from the East to Central Europe, and the northern islands, either brought with them a previous knowledge of metals from their ancient homes, or else acquired it in their new abodes, and beginning with a simple mode of obtaining the ore developed the rudiments of metallurgy independently of any influence from the South.

The opinions just mentioned, and many others, appear in modern works on archæology, and are supported by such erudite arguments that it is actually more difficult to arrive at a general view of the different hypotheses than to come to the conclusion that the important questions as to the immigration of the earliest inhabitants of Middle Europe and their original condition have yet to wait a long time for their solution.

With respect to the settlement on Lago Maggiore, in particular, nothing can be more natural than that the excellent quality of the bronze implements found there should lead to the question, whether we ought not to assume a direct influence from the civilisation of that nation which so early displayed most extraordinary skill in working bronze, one constituent part of which they were able to obtain by their own labour and the other by commerce with the Phœnicians. This idea occurs the more readily as the lake settlement undoubtedly lies in the territory which belonged in very early times to the Etruscans; and, moreover, at no great distance from it, and nearer to the foot of the Alps, the presence of that people is proved by a burial-place with Etruscan remains; and lastly, Etruscan coins and sacred images have been found in considerable numbers in the Alpine passes themselves, and even in the valleys on the northern slopes of these mountains, while an Etruscan work of art has been discovered in a Celtic tumulus. But as the Etruscans themselves migrated into Italy, and that probably by land, perhaps over the Rhætian Alps (see Mommsen, 'Röm. Gesch.' bd. i. 3rd ed. p. 121), and made the first steps towards civilisation under Grecian and Asiatic influences, the discussion of this question must be deferred until we have obtained a larger amount of materials for examination and comparison, from the labours of Italian antiquaries who are now beginning to study in earnest the remains of the earliest inhabitants of their country.

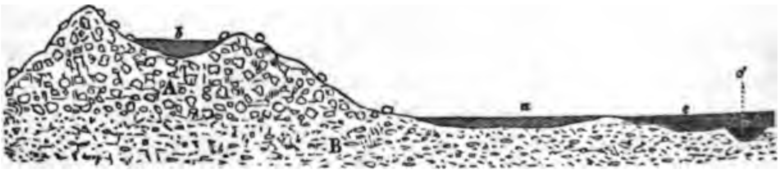
To the above general remarks it will be well to append an extract from the notices of Signor Gastaldi, who takes a great interest in the early antiquities of his country, as to the geological position of the peat moors containing remains of human industry found on the southern slopes of the Alps.

'Amongst the natural beauties with which the fertile country between the foot of the Alps and the left bank of the Po is so richly endowed, the lakes unquestionably hold the first place. All these fine expanses of water, from Lago di Garda, the most easterly of them, to the lakes of Avigliana and Trana, the last of their number on the west, derive their origin from old moraines, between the ridges of which they are enclosed as in an amphitheatre. Some amongst these numerous lakes are very small, while others are of great extent. If anyone will take the trouble of examining carefully the districts through which they are distributed—as, for instance, the environs of Avigliana, of Ivrea, of Arona, or of Como—he will soon be convinced that at some period not very distant, the number of the smaller lakes was much more considerable, and the size of the larger ones much greater than at present, and also that the small lakes which have disappeared and the flat shores of the larger ones once covered with water, have chiefly been converted into peat moors. There is no doubt, for example, in Piedmont, that all the peat moors of any extent now under cultivation have been caused by moraines. These moors differ from each other by their elevation above the lake levels, and may be divided into two classes.

'If the amphitheatre, bounded by the ranges of the moraine, is occupied by a large lake, as in those of Orta, Maggiore, and Garda, peat moors are found, the level of which rises but little above that of the water. In a similar way if the area of the amphitheatre is not covered by a large lake, but is intersected by a river, as at Rivoli and Ivrea, the moors are only a few yards above the level of the river. These are the moors which, according to my division, belong to the first class. They are in general of great extent; as, for instance, that of Angera, once a bay of the Lago Maggiore, and that of Avigliana, connected with the lake bearing the same name.

'The moors of the second class lie in rather contracted basins and at a much higher level, namely, on the ridge of the moraines. Amongst them may be named the moors of Alice, of Mengliano, of St. Martino, near Ivrea, together with those of Mercurago, of Alegio Castello and Borgo-Ticino in the neighbourhood of Arona.

Fig. 27.



a. Peat moors of the first class. *b*. Moors of the second class *c*. A lake, covering the area of the amphitheatre. If there is no lake in this hollow, a river *d* runs through it. A. Erratic or boulder formation. B. Diluvium.

It may also be as well here to mention that antiquities, chiefly of the bronze age, are found in the peat moors of Lombardy as well as Piedmont. In 1856 a bronze celt and several flint arrow-heads were found nearly ten feet below the surface in the peat moor of Bosisio: the flint was said to come from the Majolica or compact white limestone, resting on the red Ammonite limestone of the mountain between the lakes Maggiore and Garda, but Professor Doderlein thinks it was brought from the Majolica of Enego in the valley of Astico, in the district of Vicenza, where a few years ago it was worked for flints. Bronze implements have also been found in the peat moors of Brenna, and a bronze celt was dug up in a peat moor in the Venetian territory.'

PEAT MOORS OF MERCURAGO NEAR ARONA AND BORGO-TICINO.

MERCURAGO is a small place which may be reached from Arona by half an hour's travelling. Very valuable discoveries were made here by Professor Moro. Besides weapons and tools both of stone and bronze, wooden implements of various kinds and pottery, he found there a lake dwelling of such a character as clearly to prove that the little lake of Mercurago, before its conversion into a peat moor, contained similar lake dwellings to those of which remains are now met with in nearly every Swiss lake.

All the particulars respecting this settlement, and also that of Borgo-Ticino, have been given by M. Gastaldi in his report, of which the following is the substance:—

Several years since antiquities of various kinds were found at Mercurago in digging peat; such as flint arrow-heads, a bronze lance-point, Plate CX. fig. 4, a number of earthenware vessels of blackish clay mixed with quartz grains, also a wooden anchor about three feet and a half long, terminating at one end in two hooks, at the other having a hole bored through it for the attachment of a rope.

In the year 1860 a canoe was discovered for the first time, made out of a single thick trunk upwards of 6 feet long, about 3¼ feet broad, and hollowed out about a foot deep, Plate CX. fig. 23. In spite of all the care taken by the stringent orders of Professor Moro, it cracked in drying, and at length went to pieces. When I saw it, the traces of the instrument used for hollowing it out could be distinctly seen in the bottom. Not far from this boat a large bronze pin was discovered, Plate CX. figs. 1 and 2, and also a disk of baked clay, Plate CX. fig. 15, with a hole in the middle very similar to those found in the marl pits of the district of Modena and near Imola.

The peat moor of Mercurago is rather of a long shape: nearly all the things found there mentioned by me came from rather a limited space towards the northern end, about 130 feet from the bank, and apparently in a place where the water could at the most only have been from 7 to 9 feet deep when the moor was a lake. Just at this place, in making a trench, a row of piles was discovered from 6 to 10 inches in diameter, driven vertically into the greyish mud on which the peat lies, Plate CX. fig. 18. The original lake bottom is marked by dark hatched lines (*d*): a bed of mud above it is indicated by vertical lines (*c*), and the relic bed (*b*) lies immediately upon this bed of mud.

Professor Moro having informed me of this discovery, I went with him to Mercurago, where Mr. Maffei, the director of the peat diggings, had already drawn up one of the piles, and we had the opportunity of satisfying ourselves that the tool used for sharpening it must have had a curved edge, for every cut had left a slight hollow.

The piles are from about 5 feet to 6½ feet long; they are driven deeply into the mud, and project about 3 feet upwards into the peat; their upper ends are covered with peat, also about 3 feet thick. An excavation was made here for antiquarian investigation of about 30 feet square, Plate CX. fig. 21, and in this space there were found twenty-two upright piles bound together by cross timbers. Towards the bottom of the bed of peat, and at the line of separation between the peat and the mud, there is a peculiar layer or bed of fern pressed together, and upon this was found such a quantity of pieces of broken pottery, Plate CX. figs. 12, 13, 22, that a great basket might have been filled with them. Also three perfect earthenware vessels, Figs. 14, 16, and 17, a great bronze pin, Fig. 3, rather a long flint scraper, Figs. 5 and 6, with some flint arrow-heads, Figs. 7, 8, 9, 10, and 11, and many flakes of this material, besides a quantity of hazel-nuts, cornel-stones, &c.

It is very evident from all these objects, and from the situation where they were found, that a dwelling formerly existed here, resting on the piles driven into the lake at no great distance from the shore, and that it was inhabited by man before it was covered over by the peat. It is also evident from the occurrence in the same place of worked flints, of rough earthenware vessels in which the clay was mixed with quartz-grains, and of one bronze pin, that the inhabitants lived at a time when bronze was about to be substituted for stone in the manufacture of tools.

The arrow-heads are all extremely well made; the flint scraper above mentioned is 4¾ inches long and nearly $\frac{7}{10}$ths of an inch wide. It is slightly curved lengthwise; the lower side is quite flat; on the upper side there are two longitudinal flat surfaces or planes meeting in a kind of blunt angle, in consequence of which there is a sharp border or cutting edge on each side. One of these edges has been brought into the form of a saw by means of a succession of blows of the hammer, which broke off little scales from the stone.

The greater part of the pottery was very roughly worked, and was made without the help of the potter's wheel.

I cannot, while giving this account of the lake dwelling, refrain from adding a short notice as to similar antiquities found in the neighbourhood of Mercurago, but on dry land. On the elevated moraine which rises eastwards of this place and stretches down to Borgo-Ticino, fragments of pottery were found in stubbing up brushwood at a place called Il Pennino. These vessels were also made of a blackish material mixed with quartz grains, like that of the Mercurago pottery, and they almost always contain human bones, and sometimes also objects of bronze; an armlet and a pin of this material were taken out of one of these vessels by Professor Moro himself. I learned from the workmen that some years since, eighteen similar vases were found together, and that each of them rested on a slab of stone and was covered by a second. Is it possible that these vases may have some relation with the lake dwelling of Mercurago, and may the heights of Pennino be considered as the burial-place of the latest lake settlers?

If we compare the vases found at Mercurago with those which have been sent to me from Switzerland dating from the bronze age, the Italian ones appear much rougher both in workmanship and in material: the sides are much thicker, and consequently the vessels are proportionably heavier. Some of the fragments have a degree of ornamentation, but this is of the most simple kind, only scratched lines or impressed touches made on the clay while yet soft. The pattern or mode of ornament consists of the usual zigzag markings, each series of which is accompanied by a row of parallel lines. A later excavation than the one already referred to, brought to light more of this ornamented pottery, very like what is found in other similar localities, and also two perfect earthenware vessels of dark clay with the remains of cords still attached to the handles.

Two of the most remarkable things found at Mercurago are of wood and resemble wheels. That drawn Plate CX. fig. 20 was found first: it is not quite circular. In the middle there is a hole for the reception of a tube in the form of a nave.

Between this and the circumference are two openings of the shape of a half-moon. The whole consists of three boards probably of walnut-wood, and is held together by two cross-bars meeting in the middle of the circumference and dovetailed into the boards. These cross-pieces are, however, not placed in a straight line, that is, parallel with the diameter of the wheel, but bent to such a degree as nearly to run parallel with the circumference; when made, in order to accomplish this, they must have been flexible; they are of larch-wood, and charred on the under side. Professor Moro, who found that it was impossible to preserve wooden objects from the peat bogs except in water, sent me this disk in a moist state to Turin, where it was carefully modelled in plaster of Paris.

The second wooden wheel is drawn Plate CX. fig. 19; it has six spokes, two of them made out of the same piece of wood as the nave, the other four are fastened into the central piece and the fellies. The different parts of the wheel itself or the fellies are mortised together by pieces of wood let into rabbets. These holes or rabbets are made with the greatest nicety, and prove that an instrument with a curved edge must have been used to cut them. The portion of the wheel marked *a*, *b*, is in one piece, and like the remaining parts of the circumference, appears to be of walnut-wood. Not the slightest trace of metal is to be found in the whole wheel.

Earthenware vessels precisely like those of Mercurago are found in the peat bog of Borgo-Ticino, which belongs to the first class, and lies at the level of the Lago Maggiore.

A great number of earthen vessels, of flint arrow-heads, and some objects in bronze, were found in the moor of Gagnano, situated a short distance from those just mentioned, but they were all dispersed or thrown away. On the bank of this basin I have seen piles almost identical with those of Mercurago, the only difference being that they were sharpened by fire at the lower end. I have noticed that charcoal and ashes, as well as wood that had been worked by human hands and trunks of trees partially burnt, are very commonly met with in the peat moors of Arona and Ivrea. The stems of trees found in abundance in these moors belong to the following species:—Italian pine, oak, alder, birch, willow, walnut, all of which, as it appears to me, have grown on the spot. Only twenty years since the peat moor of Gagnano was pasture land, but now that the peat has been cut away to the depth of 16 or 18 feet, the moor has again become a lake.

In the neighbouring moor of Conturbia remains of later date have been found. Nearly in the middle of the moor there are a number of piles driven into the peat which, according to the account given by the manager, had the lower end furnished with an iron point. I managed to procure one of these piles; there was no iron on this one, but I was quite convinced that it had been sharpened by instruments similar to those in use at the present day.

PEAT MOOR OF SAN MARTINO AND TORRE BAIRO NEAR IVREA.

This moor lies on the ridge of a moraine, in fact just where, near Ponte dei Preti, the straight line of the lateral moraine begins to bend so as to form the terminal moraine. The basin thus enclosed is nearly oval: its greatest breadth is about a mile and a quarter, but in some places it is only five furlongs across.

Surrounded by meadows and fields, interspersed with groves of high trees, and with the small village of Giovanni to the north, surrounded by chestnut and walnut woods, this basin has a quiet and picturesque appearance, a thing very unusual in the peat districts.

No remains of regular piles have as yet been discovered in the moor of San Martino which indicate positively the existence of a lake dwelling in the ancient lake; but still within the last few years two earthenware vessels and a worked flint were found there. One of these vessels, Plate CXVII. fig. 1, which is in my possession, shows no marks of the potter's wheel, and is of very rough workmanship, although some rude attempts at ornamentation may be observed in a series of deep impressions, about an inch and a half below the rim, made by means of a piece of wood or stone. The shape is nearly that of a cylinder, rather diminishing towards the base. The material is exactly like that of the vases of Mercurago, and consists of blackish clay mixed with quartz-grains. The fact of antiquities of this kind being found in the moor proves that a Celtic race once had a settlement on the border of the former lake of San Martino, and makes it almost certain that the lake dwelling itself will soon be discovered. Besides this weir baskets or fish-traps, made out of osiers, have been found about a yard deep in this as well as in several of the small moors of the neighbourhood. The bronze sword from the Lago di Viverone, Ivrea, Plate CXVII. fig. 2, may be compared with some of the bronze swords found in the actual lake dwellings.

The peat moor of Torre Bairo contains fragments of earthen vessels which appear to have been made by the wheel, and a small millstone has been found in another moor. We must not omit to remark that great care is necessary in determining the age of the antiquities found here, for though the neighbourhood of these moors, judging from the objects found in them, was evidently peopled in prehistoric times, yet there can also be no doubt that these localities were afterwards densely inhabited in the Roman period: this is proved by the number of brick graves, containing vases of a very different character, which are frequently discovered in stubbing up bushes.

LAKE OF VARESE.

In the year 1863 the Abate Professor Antonio Stoppani, discovered five lake dwellings in this lake; a sixth was subsequently found by the Abate Giovanni Ranchet.

1. Isolino, the largest settlement, with numerous piles. The antiquities found here were flint knives, worked bones, and a number of fragments of bones of the stag, the goat, the ox, and the pig; also spindle-whorls and pottery.

2. Cazzago, a lake dwelling, but not of much interest.

3, 4 and 5. These three stations are all near Bodio. The most easterly of them has been called Keller, that to the northwest has been named Desor, and that nearest Bodio, the Central station. Of these three that near Bodio is the richest and the most important. A number of arrow-heads and some axes of flint were found there, spindle-whorls of sandstone, a ring made of quartz; some fragments of pottery and a few bronze implements, amongst which are a pin, some fish-hooks, and two lance-heads. The station called Keller is a repetition of that of Bodio, with the exception of the bronze implements; a number of arrow-heads were found here barbed and of excellent workmanship. In the station called Desor pottery is very abundant.[1]

6. Bardello is a station of small importance.

(See the 'Rapporto sulle Ricerche nel Lago di Varese,' by the Abate Antonio Stoppani, 1863.)

Supplement to the Lake of Varese.

Respecting the later discoveries in this lake, it will probably be the best plan to give a very condensed summary of the different stations, and of what has been found in them, taken from the work of Dr. Camillo Marinoni, in his report to the

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[1] Some of these settlements, it appears, have been named after the Swiss savans. —[Tr.]

'Società Italiana di Scienze naturali, Tomo. IV. N. 3,' entitled, 'Le abitazioni lacustri e gli avanzi di umana industria in Lombardia,' 1868. This report contains all that was given in the first edition of this work together with notices of the later discoveries.

The attention of Italian antiquaries was first roused by the discovery of stone implements near Brescia, in the peat moor of Bosisio and elsewhere, and also by the announcement that a true lacustrine prehistoric settlement had been found by Professor Moro in the peat fields of Mercurago, near Arona, on the right bank of Lago Maggiore, the relics from which had been illustrated by Signor Gastaldi, in his 'Nuovi Cenni': and subsequently this interest was increased by the fact that Professor Desor, in company with M. Gastaldi, had ascertained their existence in the Lago Maggiore, and that M. de Mortillet believed that he had found them in the Lake of Iseo.

Still nothing very definite occurred till Professor Desor, in April 1863, in company with Professor Stoppani and M. de Mortillet, examined the Lake of Varese. They then proved the existence of two large pile settlements, and subsequently Professor Stoppani continued the researches, and made reports on his fresh discoveries to the 'Italian Society of Natural Sciences,' vol. v. page 423.

The settlement of Bardello, as will be seen subsequently, was discovered by the Abate G. Ranchet di Biandronno, and this energetic explorer afterwards extended his researches till seven settlements were known in the lake. Captain Angelo Angelucci was also very active in the exploration of this lake.

The Lake of Varese is about 5½ English miles long from north to south; its greatest breadth is less than 2½ miles; the average breadth is about 1½ mile; the greatest depth is about 85 feet.

All the seven settlements are on the western bank, that of Bodio contains in fact three separate stations—Desor, Central, and Keller.

Isolino, otherwise called Isola Camilla.

Cazzago.

Bardello.

Gavirate.

Some particulars respecting these stations, and the objects found in them shall now be given.

Isolino, or Isola Camilla. This was the first lake dwelling discovered in the Lake of Varese, April 21, 1863. It was found by MM. Stoppani, Desor, and Mortillet. Captain Angelucci calls the island Isola Camilla; it is a little east of Biandronno. The settlement itself comes very near the island, and is in the shape of an oblique quadrilateral about 220 yards long, by 33 yards wide; the area is about 7,200 square yards; it runs along the eastern shore of the island following the marshy banks, which it almost touches in some places; so that in the dry season the piles nearest the shore are probably dry, although under ordinary circumstances they are covered with water $4\frac{1}{2}$ feet deep. The piles are very numerous, and can be seen just rising above the muddy bottom. Professor Stoppani reported the fact of a large number of pebbles and stones being seen on the bottom, as it were, in round heaps, through which the tops of the piles appeared, these apparently were similar to the *ténevières* or *steinbergs* of the Swiss lakes. This fact has led some antiquaries almost to believe that the whole island of Isola Camilla might be artificial, like the Irish crannoges.[1]

Professor Desor at first thought that this was a bronze age settlement, although at that time neither bronze nor stone implements had been found there; this opinion was simply formed on the superior character of the pottery. Now, however, stone implements have been found here by which I am led to consider the settlement as having originated in the stone age, but still with the possibility of its having lasted into the age of bronze, and we may suppose that in this latter period the better kind of earthenware was manufactured.

The pottery found here is for the most part rather black in colour, and the sides are thick, sometimes even $\frac{6}{10}$ or $\frac{3}{4}$ of an English inch. The vessels appear to have been of a large size, in most cases with a narrow flat circular base, so as to be quite self-supporting. They are very smooth, especially inside; the clay had been mixed with small fragments of mica or felspar. They are hardly ornamented outside, but the shapes of them are very varied. The only things which may be called ornaments are some projections from the sides, which may have been used as handles. The bottom of one vessel was found which had a concave base or pedestal, like a reversed funnel. Professor Desor said that similar vessels had never been found in the Swiss lake dwellings, and the only other places in which they have occurred are the peat moors, such as Seste Calende, and amongst Roman remains. All these fragments seem to have been blackened by fire. In one of the later excavations some pieces of pottery were found with line ornaments, Plate CLXIV., figs. 2 and 3, these fragments had belonged to vessels of a superior kind, the clay of which was finer, and the vessels better manufactured. These were the specimens which led to the first idea that Isolino had been a settlement of the bronze age.

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[1] This appears to be very doubtful, at any rate to those who have not seen the locality, but it seems to me that a very slight examination of the place would soon prove whether there is any truth in the hypothesis.—[TR.]

Besides pottery, flint- spear- and arrow-heads, in various shades of colour, were found here; also a number of scrapers, and a very large quantity of flint refuse.

Two beautiful stone celts were also obtained here. One of a grey brown serpentine, like sandstone, is small but well ground to a sharp edge; the other, which is much larger, is of greenish serpentine schist.

A large number of bone awls or pointers were also found, see Plate CLXIV. figs. 5, 10, and 11, Plate CLXII. figs. 22 and 23, and spindle-whorls, like those of the Swiss lake dwellings, chiefly made of terra cotta, Plate CLXIII. figs. 3 and 4. One of these earthenware spindle-whorls, was lately found of a somewhat conical shape. Plate CLXIV. fig. 4. The base is flat, and ornamented with a series of depressions disposed in a circular shape. The spindle-whorl drawn, CLXIII. fig. 5, is of sandstone. Plate CLXII. fig. 13, if a spindle-whorl, is of very hard stone.

A very large quantity of bones broken lengthwise for the sake of the marrow were found here, and also a great mass of fragments of bones, the remains of the settler's feasts. The only bronze object from this station was a beautifully made hook, exactly like those from the Swiss lake dwellings.

Cazzago.—This place is called by Professor Stoppani a trial station, or an attempt to form a settlement. It is situated immediately opposite to the village of the same name. The piles are few in number, and scattered. Teeth of animals, fragments of flint, and pottery of a very coarse manufacture were found there.

Bodio.—As before mentioned, there are here three stations: The northern one called Desor, or, by Captain Angelucci, Maresco; the southern one called Keller, otherwise Gaggio; the central one, called Della Monete, is between the other two, at a distance from them of about 870 English yards.

This was the station first discovered, and appears to be built somewhat in the form of a horse-shoe round a point rising from the bottom.

These three stations are all near the shore, only about 20 or 30 yards from it, and they all resemble each other except in some few particulars; but a large quantity of mud, ashes, and charcoal, covers the whole bottom, surrounds the tips of the piles, and hides the heaps of stone beneath.

The lake dwelling of Desor is very rich in pottery, so much so as to lead one to imagine that it was manufactured there. Plate CLXIII. figs. 1 and 2 are drawings of two fragments which, though coarse, are ornamented with dots, lines, and concentric circles. Fig. 6 is a fragment of a vessel with a band round it. A large variety of handles of vessels is found here, and most of them are remarkable for their similarity to the figures given by Gastaldi in the 'Nuovi Cenni' of pottery from Mercurago. These vessels appear to have been made on the spot. The potter began from the bottom, which was very thick, and regularly built up the vessel, afterwards adding the handles, projecting rims, or ornaments. In general the pottery is coarse, and the vessels rather large; some appear to have been merely sun-dried, while others had been exposed to the action of fire: some still retain charred matter in the inside.

The central settlement is particularly remarkable for its flint arrow-heads; more than one hundred specimens were found here, some of them very well made, Plate CLXII. fig. 1; in fact, the lake dwellings of the Lake of Varese are notable for variety of form in the flint arrow-heads.

The two more common types found here are met with all over Lombardy; it is only in the peat moors that some forms are found which slightly differ from them. The most common shape is that drawn Plate CLXII. fig. 1; it is of a triangular form, with two little wings or barbs, and with a central stem or projection exactly like those mentioned in Dr. Keller's reports. A very large number of flints were found, some of a rough rhomboidal figure, which by some antiquaries are not considered as arrow-heads, while others think that they are arrow-heads partly finished. In the Milan museum there are specimens of different kinds, from the rude triangular shape to the perfect arrow-head. Several of these from Bodio are drawn, Plate CLXII. figs. 1 to 10, showing the different modes of manufacture. Captain Angelucci has given similar drawings of arrow-heads in their different stages of progress; he was so fortunate as to find a very perfect one of quartz, now in the Museum of Artillery at Turin.

A spear-head of brown flint, about 2¾ inches in length, was found here, Plate CLXIV. fig. 6, and a second, fig. 8; also a small chisel and a number of flint scrapers, figs. 9, 12, and 13, some of them quite as well made as those brought from Mexico, which had been used by the Indians there. Some few of the flints were serrated at the edge, and with a handle would have made very effective saws, fig. 7.

Flint flakes and the refuse of the manufacture were abundant, in fact, the bottom of the lake was sometimes covered with them mixed with bones, the refuse of the settler's feasts, and charcoal; all these mixed together made up what is called the relic bed of the lake dwellings.

Very beautiful stone celts were also found of a stone like serpentine; also polishing or burnishing stones, more or less fine, of various forms, and sizes, and net weights,[1] Plate CLXII. fig. 20, which may possibly also have been used as weights for the loom, although we have no proof, as in Switzerland, that looms were employed here. Fig. 19 is an ornament for suspension made of schist, and fig. 21 is an amulet or ring of quartzite.

In the central settlement of Bodio some few bronze objects were found, viz., two lance-heads, Plate CLXII. figs. 11 and 12, somewhat similar to those found in the Terramara, although the ornamentation differs slightly. A hairpin with a globular head, fig. 18, and fish-hooks, figs. 14, 15, 16, and 17, like those now in use, and similar to some from the Swiss lake dwellings.

These bronze objects seem to indicate that the central station of Bodio has probably existed during more than one age; in fact, the settlement called Keller may possibly have lasted equally long, for one bronze hook was found there. One curious fact ought to be mentioned, though probably it would be wrong to apply it in the same manner. In the central station not less than 130 Roman coins were found, the greater part of silver, and all belonging to the last half-century of the republic. There were 33 consular coins of the following families: Afrania, Antonia, Calpurnia, Carisia, Clodia, Cornelia, Cepia, Junia, Mescinia, Minucia, Sempronia, and Vibia. Amongst these the Mescinia are the most valuable, but they are much worn. Six are legionary coins of Marc Anthony; nine are triumvirates of the time of Pompey, Cæsar, and Augustus; and six are imperial coins of Augustus; one is of King Juba. Many others are too much worn to be recognised. These coins can only have come here by accident. It is very easy to find in Italy objects of the most remote ages brought together in one place. Where have not the Romans left their traces?

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[1] The idea that these perforated discs of stone or earthenware were net weights is borne out by the fact that similar objects are used for that purpose by the fishermen in the Lake of Lugano at the present day.

The settlement of Bardello is also worthy of remark. It was first noticed by the Abate Canchet in the autumn of 1863. It was built on a double row of piles about 10 English feet apart; the outer piles being thinner, and those inside thick and strong, driven in regularly, but with an open space between the lines. Behind this double line the piles had been driven in irregularly, taking the approximate shape of a horse-shoe. It is situated about 330 English yards from the mouth of the river, to the north-west it is about 170 feet long and the same wide; it is about 18 or 20 feet distant from the present shore, and the depth of water varies from 15 inches to 4 feet.

Flint implements were found here, a spindle-whorl and pottery, evidently fragments of large vessels, one vase of black ware, and a pendant or amulet. A very large quantity of bones of the ox and goat were found here; most of them had been broken lengthwise for the sake of extracting the marrow. Some of the bones also had been worked into tools.

The settlement under Gairrate is not of much interest; it was discovered much later than the others, and has not as yet been carefully examined.

LAKE DWELLING OF PESCHIERA ON THE LAKE OF GARDA.

The discovery of this settlement is of considerable interest, as from its geographical position to the south and east, it shows that the tract of country where the phenomena of lake dwellings are observed is more extensive than was at first supposed. Together with the settlements of Mercurago, of Castione, and those of the Savoy lakes, it proves that the lake dwellings south of the Alps were founded in the stone age, but were not fully developed till the period of the common employment of bronze. And with respect to the general history of civilisation, it opens to us a view of the connection between the settlements of Switzerland and Upper Italy. For it may be remembered that the bronze implements found at Peschiera differ very little from those destined for the same use found in Switzerland; or, to speak more correctly, most of them agree so completely with the objects found in the Lakes of Neuchâtel and Bienne, and now preserved in the collection of the late Col. Schwab, that we cannot deny that there must have been an active traffic between the settlements on both sides of the Alps, a mutual influence and a similarity of civilisation between the two.

Amongst the number of objects which were forwarded from Peschiera to Zürich, and which of course are only a small portion of the things obtained there from the bed of the lake, there are several implements of metal not made of bronze, but of copper, and, as we shall see, identical both in material and shape with those found on the mainland in the east of Europe. These copper implements induce me to call the attention of antiquaries to a fact which has hitherto remained without attention. In all the works which have come before me, treating of the development of civilisation and the introduction of metals in the western countries, it is affirmed that the use of copper necessarily must have preceded that of the mixture of this metal with tin, that is of bronze: but notwithstanding this, and even though copper tools are occasionally met with, though very rarely, yet that a copper age has never existed in Europe,[1] for the transition from pure copper to bronze did not take place in Europe. This assertion is partly correct with respect to Western Europe, but does not apply to the whole of the continent, more especially to the east of it, such as Hungary and the countries lying east and south of it. My friend, the late well-known mechanist, Mr. William Fehr, during a residence of many years at Pesth, directed his attention to the implements of the early ages found richly developed and in incredible numbers in the country of the Lower Danube, which are accumulated in the museum at Pesth, in private collections, and in the shops of the dealers in antiquities. He assured me that in certain localities of Hungary copper implements are just as plentiful as those of bronze: and he presented to the Zürich collection some hundred specimens, amongst which a considerable number are of copper. The facts that the very largest and heaviest tools were made of pure copper, and also that cutting instruments like axes were of the same material, indicate on the one hand a considerable abundance of copper, and on the other the original non-existence of bronze.[2] From the information which our friend was able to give we may conclude with certainty that copper was used by one of the earliest populations of those countries for implements of war and the chase, for those of husbandry, domestic economy, and ornament; and that it was employed for these purposes during a lengthened period. For the sake of comparison, sketches of a number of these bronze objects from Hungary are given Plate CXX. figs. 1 to 28.

The appearance of copper in such quantities in these districts involves the discussion of the question to what nation these implements belonged, and further whether these people made them themselves or obtained them from other races either to the south or the west. But the primæval history of Pannonia and Dacia, like that of Western Europe, is shrouded in darkness, nor is the period of obscurity passed when some faint light begins to appear, and the names and races of peoples then existing are known. Even when copper was exclusively in use, we are still, to a great extent, ignorant of the races who used these weapons. When the districts south of the Danube, when Turkey, Greece, and the countries bordering on the Black Sea have been more closely examined as to the remains of their earliest civilisation, it will then, perhaps, be more possible to determine whence these implements came, and by whose means they were brought into the districts under consideration. Sufficient has now been said merely to notify the extensive diffusion of copper in Hungary.

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[1] This sentence has been left precisely as in the first edition of this work, although it is possible that opinions may now differ on the subject.—[Tr.]

[2] According to the accounts given in the 'Archæologiai Közlemények,' implements of bronze as well as of copper have been found in the districts (comitaten) on both sides of the Danube, in the countries of the Pannonians, Iazyges and Dacians, and in many places, for instance at Ipoly-Damasd, in the district (comitat) of Hont, and at Parndorf, in the district of Moson, they occur in great abundance and variety of form. As moulds for casting were also found there, these bronze implements were believed to have been made in the country itself by some of the Celtic race who had wandered there. In the atlas given in the Archæologiai Közlemények, which contains very good drawings of the copper and bronze implements found in Hungary, by far the larger number of the weapons, tools, and ornaments are marked as consisting of copper.

Unfortunately the information as to the settlement of Peschiera is not, as is the case with some other lake dwellings, based on a careful investigation of the locality. All the information we possess respecting it has been kindly communicated by M. von Silber, first lieutenant of the Austrian corps of engineers at Verona. He discovered the place and secured some of the objects found there, which he kindly forwarded to us together with the following report as to the locality and the circumstances under which the discovery was made.

'In deepening the entrance of the harbour of Peschiera for the newly-built gunboat, which was done by means of a mud machine (called a *paternoster*), to a depth of seven or eight feet below the usual level of the water, the workmen found amongst the mud and sand brought up by the machine, a great number of bronze implements. These were carefully preserved, for the sake of archæology, by Mr. Lorenz, the marine engineer now residing at Pola, and myself. I was so uninitiated in this science, that when I found that the greater part of the objects had been taken up from a space of a very few square fathoms, I had the notion that a ship laden with bronze had been wrecked here, and it was not till a conversation which I had with Dr. Freudenberg, of Bonn, that I was led to believe that a lake dwelling probably existed on this spot. This idea was corroborated by the fact that, just in this place, the working of the mud machine was very much impeded by a number of burnt piles which were quite covered with the mud. Unfortunately, I fancied at first that these piles came from the fishermen's huts, which abound in this neighbourhood at the present day, so that I paid no attention to their position or arrangement. The piles which were drawn up were, on an average, four or five feet long, quite hidden under the sand, and burnt to such a degree that it is quite impossible for me to say with certainty what kinds of wood they were made of. I imagine, however, that the wood was chiefly that of the stone oak (*Quercus ilex*). The piles were four or five inches in diameter.

'Besides the bronze implements one of stone was found, which I believe to be a sling-stone. Lately, when reading the reports of the Swiss lake dwellings, I remember the occurrence of a great number of pieces of burnt clay found in the mud. These pieces were of a blackish colour, remarkably thick, and without any definite form. I do not doubt that they have been fragments of the clay covering the huts of the lake dwellings.'

The objects found at Peschiera are drawn in the following plates:—

Plate CXVIII. figs. 1, 3, and 4 appear to be daggers; 2, 5, 6, 7, 8, 9, spear-points—similar objects to these last are found in the Swiss lakes; 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, hairpins and clothes pins; 15 and 23 are needles. The whole of these are of bronze, and many are very similar to specimens in the collection of the late Colonel Schwab, of Bienne. Plate CXIX. figs. 4, 11, 12, 13, 14, hair or clothes pins; 1, 2, 3, small harpoons; 5, great clasp, or armilla, ornamented with engraved lines; 6, 9, spirals; 7, 8, fibulæ; 10, knife, the handle broken off; 18, tube, with engraved spiral ornament; 19, chisel. The whole of the above are of bronze. Figs. 15, 16, 17, copper chisels; 20, disk of granite (sling-stone ?); Fig. 21 gives a plan of Peschiera, where the Mincio joins the Lake of Garda: the locality of the lake dwelling is marked with †.

Since the above account was written, Dr. E. Freiherr von Sacken has published a full report of this station, taken chiefly from the account given by Captain von Kostersitz who was present at, and carefully watched, the excavations in the years 1860, 1861, and 1862. The area examined by the machine up to 1865 consisted of about 10,600 square yards. Numerous piles were found placed irregularly, which had been driven from three to six feet into the mud. The depth of water is about five feet. Large quantities of pottery were found of the usual forms, and a number of bronze implements, such as celts, lance- and arrow-heads, knives, sickles, awls, and pins.

Supplement to Lago di Garda.

Since the above discoveries Professor Stoppani has proved the existence of several lake dwellings of the stone age on the western bank of the lake. They lie near together within the Gulf of San Felice di Scovolo, and are sheltered from the open part of the lake by a series of rocks stretching from the point of Manerba to the Isola di Garda or Isola Lecchi, forming a semicircular bay. There is also a small lake dwelling under the shelter of this island.

There are three lake dwellings in the Gulf of San Felice, an eastern settlement about 143 square yards in extent, a central settlement very near the shore with an area of from 100 to 110 square yards, and a western settlement, of which little is known.

There are two settlements at the Isola Lecchi, one to the east and the other to the west.

All these lake dwellings are of the same character, they are very near the shore, and not much below the level of the water: the piles are rather black, of large size, and they project but little above the lake bottom.

It was only in the settlement of the Isola Lecchi that certain indications were obtained of the age of these lake dwellings; for, scattered about on the bank were a number of fragments of both yellow and brown flints, amongst which there was a scraper, also many fragments of pottery made of a similar clay to that used in the manufacture of vessels found in the Lake of Varese.

The only specimens found in the other stations were a few worked flint fragments.

THE LAKE DWELLINGS OF FIMON NEAR VICENZA.

By Sig. Paolo Lioy.[1]

In the valley of Fimon, at a short distance from Vicenza, there is a small lake which, within the memory of man, before the Debba canal was cut, had been much larger, and in former ages had occupied all the valley as far as the little lake of Fontega. The little hills of Montesello and Bisortole were then islands in the middle of it, and it was closed in by the natural bank formed of the limestone hills stretching from Arcugnano to Villabalzana. It seemed to me that this was a very likely place to find the remains of lake dwellings, but all my inquiries and excavations were futile; till at length in the meadow called Pascalone (less than two feet above the level of the lake at low water), I discovered a pile dwelling, traces of which could be distinguished for many square yards.

The piles, which were at various distances from each other, and were sometimes in groups, had only their tops above the surface of the ground. They were from 8 inches to nearly a foot in diameter, and looked like trunks or stems broken off short: they were charred at the top: in some cases the woody matter was very hard, in others soft, and many of them had the beautiful appearance of ebony. One which I had drawn up and which is now in the museum of Vicenza was about 18 English feet long, and had been forced into the clay of the lake more than about two-thirds of its length. They were driven into the ground by the thinner end, and were not actually pointed, but the ends were roughly cut with blows or in a measure sharpened with fire, of which there are evident traces. In some places the piles were surrounded with heaps of stones. Between these piles the upper bed is a mass of peaty mould of varying thickness (on the average about 16 inches thick); then follows a deposit of lake marl of a thickness which varies according to the slope of the bottom of the lake (on the average about 3 feet 4 inches thick). In this bed various shells are found buried, of the genera *Unio*, *Limnea*, *Paludina*, and *Anodon*; in the last of which the pearly lustre was beautifully preserved—they are all perfect, and are evidences of the slow and quiet deposition of the mud. The alluvium of the river Bacchiglione did not in truth penetrate into this basin, for before the Debba canal was cut the river ran within the banks, so that, as I had already foreseen, the antiquarian objects in the ancient lake, if they occurred here, would be found at no great depth, but merely under the slight deposit from the water, which was kept nearly clear by the rivulets running into it from the neighbouring limestone hills.

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[1] The account here given is merely an epitome of the rather voluminous report given by Signor Lioy. In his quarto volume he includes the results of excavations made in the Italian caves, and also enters into several questions, which, however interesting, would be out of place here.—[Tr.]

The section of the beds is given in fig. 1. of Plate CLXIX.
The bed marked 1 is the bed of vegetable earth.
" " 2 " " of peaty mould, 16 in. thick.
" " 3 " " of lake marl, about 3 ft. 4 in. thick.
" " 4 " " called the relic bed, about 12 in. thick.

This last bed is full of ancient remains, it is of a yellowish black colour; when cut into, it is like soft dough, it exhales a strong sulphurous odour, and is about a foot thick. It consists of a mixture of bones, pieces of pottery, bits of straw and reeds, wild fruits, flints, and other worked stones, pieces of wood, ashes, and carbonaceous matter, and here and there a quantity of crystals of spar, quartz, and carbonate of lime. All this refuse accumulated under water beneath the huts and lay on the old bottom till they were covered up with the mud. These were all deposited around the piles, which must have supported the platform, but the pieces of board found are both rare and imperfect, so that trunks and branches seem to have formed the floor. Reeds and bundles of wild fern have been found, and also pieces of hard smoothed clay, convex on one side, and concave on the other, with straws and reeds still adhering to them, or in some cases with their impressions.

Below this relic bed was the original lake-bottom, which was examined to a depth of more than 10 feet without finding any difference in its character.

The piles although placed irregularly had a tendency to circular arrangement: this fact, and the curve of the clay slabs which formed the outside plastering of the walls, shows that the small huts were oval, oblong, or round, crowded together. The roof was probably conical, and covered with reeds and boughs.

The floor must certainly have been provided with holes or trapdoors, through which were thrown into the water all the remains, offal, pottery, and implements. No traces of a bridge connecting the settlement with the shore could be discovered; it appears to have stood like an island in the lake. A portion of a canoe was found not far off buried in the mud; it had been made of a trunk hollowed out by fire, the traces of which are still to be seen. The remains accumulated on the lake-bottom give us some idea of the implements, arms, field sports, food, and dress of the builders of these huts, but no trace of agriculture is met with, nor are there any marks on the wood of sharp hatchets, saws, augers, or nails—no smoothed or squared wood, and no metal. The rude implements and arms were of wood, stone, and bone; amongst the mass of rotten and burnt wood, many wooden implements might probably have been distinguished, but they were mixed up with burnt sticks, piles, and branches, and had lost all their form, and the very few which were found had hardly been exposed to the air before they cracked and broke to pieces. Amongst the few things which can be mentioned are a little shovel with a handle, a stake with a head at the top, and some small sticks, cylindrical and peeled, the length of an arm; these were the only specimens of peeled wood found here.

The rough stone implements were made out of the limestone of the neighbouring hills—very seldom of sandstone—but more frequently of flint, which is almost always of a light blue colour. These flints come from the Alps or the spurs of the Alps, and there are plenty of chips, unfinished implements, nuclei, and refuse, hence it is probable that there was a manufactory of flint implements here. The different types both of arms and implements found here are few in number, and most of them unfinished.

There were also common celts or hatchets made of flint, but they were very rude and primitive. One of limestone shows where it had been fixed on the handle. There were implements of sandstone, some in the form of wedges or chisels; others flat and smooth. The usual flint arrow-heads, either oblong, or leaf-shaped, or in the form of an almond, Plate CLXX. fig. 1; the triangular form is rare, Plate CLXX. fig. 8. I found some of the more common forms, Plate CLXX. fig. 2, and some small knives, Plate CLXX. figs. 3 and 4, and saws; also lance-heads, Plate CLXX. fig. 6—one of these was very well made, and pedunculated, Plate CLXX. fig. 5. Pebbles of limestone in the form of hammers, but not perforated; numerous slingstones, Plate CLXX. fig. 7, made of sandstone, basalt, and serpentine.

A fragment of granite flattened and polished on all the four sides. Many of the bones were made into peculiar shapes, there were stag's horns sharpened at the top and perforated at the base, pointers, spear-heads, spatulæ, and splinters of all kinds.

The fragments of pottery are so plentiful, that a handful of the mud could not be taken up without finding some pieces amongst it, and a very large quantity might be obtained, but in general they are in small pieces. With the view of selecting the most remarkable, I have looked over some thousand pieces, and have succeeded in obtaining about fifty earthenware vessels, either perfect or in tolerable preservation. In colour they are blackish, ferruginous, or rust-coloured; they are light, made by the hand alone, and appear to have been exposed to a slight heat in an open fire. Some of them have been chemically analysed by my friends, Fasoli and Grandoni, the professors of chemistry, and were found to consist of muddy clay mixed with coarse bits of gravel, quartz, and carbonate of lime, the crystals of which glittered on the porous and uneven surface. When pounded and exposed to a strong heat the weight diminished, and the blackish colour changed to that of ochre, all which indicates the presence of carbonaceous matter. During the action of the fire a strong sulphurous odour was exhaled.

The vessels made of grey-coloured clay are scarcer; they are less porous, made of a finer paste, which has a smaller quantity of the gravel mixed with it. On being exposed to the action of fire their weight is but slightly diminished, and they exhale but little sulphureous odour; the colour becomes an orange red; when broken there appear two bands of almost equal thickness —the outer one of the colour of ochre, the inner one rather black, and from this it appears that they had originally been more completely baked.

The general appearance of this pottery is singular, it possesses a certain amount of elegant rudeness—a type of decided barbarism, of 'poor but of splendid simplicity.' As a general rule the vessels found whole are small; in fact, the greater number of the fragments seem to have belonged to small vessels.

The vessels used for cooking are the rarest; in some few there are traces of prolonged exposure to the fire; none have feet, and none lids or covers. There are but few types, but all differ from one another.

Some are thick, others on the contrary are very thin. These last (bowls, cups, and tazze), in general, have no signs of exposure to fire or to flame, but are small and are ornamented sometimes with projecting knobs, occasionally with bands in relief, or with some other kind of ornamentation; their edges or brims are plain and straight. The vessels with a bulge, such as pipkins and pots, on the other hand, are dried in the smoke, and sooty, and must have been used for cooking, some of them have still carbonised matter adhering to the inside; they are without knobs, bands, or any other ornament—large, thin, and with the rims curved outwards.

The most elegant type is that of the cups or basins—only a few of the larger bear traces of soot in the bottom and on the sides. On some may be seen one, two, or even three knobs or small tubercles on the outside near the brim.

They are of a greenish copper-coloured black; the surface is coarse, wrinkled, and uneven, sometimes the brims are slightly curved outwards, Plate CLXXI. fig. 1. The flat bottom, in some cases, slightly projects all round. The handles are large, some being nearly round, and placed on the upper half of the cup; but these handles vary exceedingly both in shape and position, as may be seen by referring to the specimens drawn on Plate CLXXI. The upper part of some of these handles has two rudimentary tubercles.

The ornamentation is very simple; in some cases we find nothing but a row of knobs, in others an ornament like a band runs round the whole vessel. Sometimes there are two bands running parallel with each other, Plate CLXXI. figs. 2 and 3, or a single one descending perpendicularly from the mouth to the bottom of the vessel. In the vessel drawn, Plate CLXXI. fig. 1, the sides are ornamented towards the middle with coarse projecting lines all leaning in the same direction.

The tazze or bowls are no less characteristic than the cups, almost all had very large handles, the smaller as well as the large ones. An immense quantity of the fragments of pottery found belong to this class, the colour is brown or dark grey; the sides are rough and uneven, some diminish from the top to the bottom, which there projects a little; the edges or lips are straight. The handles, which are round, sometimes start from the bottom, and join the vessel about half-way up; others begin at the bottom and go to the very top. In some cases they take the form of an acute angle, the upper side of which is hollowed out, and has rudiments of projections, Plate CLXXII. fig. 1; others spring from the middle of the outside, and the upper part of the handle is higher than the brim. The bottom does not always project; some are as broad at the top as the bottom, and others just the contrary; the smallest is drawn, Plate CLXXII. fig. 3; some have knobs like the cups, Plate CLXXII. fig. 1, and others have the usual circular projecting band.

The most remarkable vessels from the Lake of Fimon are without any bulge; but there are many others, such as pots and pipkins, which are bulged. These have thinner sides and seem to have been more burnt; they are less black in colour, in fact of a dark grey, in some rare cases of a muddy earth colour; they are destitute of knobs, projecting bands, or of any kind of ornament; some few fragments, however, have been found with mammillated projections.

In some small pots may be seen the characters of all the bulged vessels; the brims are curved outwards, occasionally the base which is convex touches the ground only in the centre, but in many cases the centre is raised so as to form a hollow beneath. The handles are round, Plate CLXXII. fig. 4, or at a simple acute angle, or they are finished with a short appendage slightly bituberculated, Plate CLXXII. fig. 2. Some have the appearance of flattened globes, and are broader than they are high, and have the handle in the middle; others again are a little swelled out, and the handle, which is in a slight degree angular, rises from the lower half and joins the vessel below the brim.

The large pots and pipkins are sooty externally, some of them still have inside a crust of carbonised matter, the remains of the food cooked in them. The former are bulged with projecting brims, and the handle is in the upper part or near the mouth; there are some in the form of a double cone, with the bases united. Some are very large, considerably bulged, and with very projecting rims—these vessels are very narrow at the bottom. The pipkins (ollæ) have no handles; some which are narrow at the bottom grow larger towards the mouth, which then narrows abruptly; the lips or brims are in general not projecting, as the edges are formed by the narrow sides or walls, but in one fragment I saw the lower part bulged, and it had a projecting rim; in another case where the vessel was wider in the middle, and the rim curved outwards, the diameter of the mouth was nearly 10 inches, the height of the vessel would be above 7 inches, and the greatest breadth 16 inches.

Amongst the heaps of broken pottery, the greater part of which consisted of small pieces, a few fragments remain still to be described. Some seem to belong to large vessels, they are black with very thick sides, and made of a coarse clay; others have a circular projecting band or two bands running parallel close to each other; in one case one band is much lower and has knobs above it. In the bottom of a small vessel of an earthy colour there is a small perforation, and in another similar vessel there are two holes.

The vessels which differ from the few common types are very rare, and may be said to be unique, one is a small drinking vessel rather narrowed at the bottom, slightly larger in the middle, and without a handle; it is of a grey colour, and made of coarse clay mixed with a large quantity of sand. Another is a goblet more than 9 inches high and wide, of an earthy mud colour, the base is flat, from the middle of which rises the stem or neck supporting the cup. Another is a diminutive bowl of a somewhat globular shape, but flattened; the sides are very much swelled out, and the mouth is narrowed; it is 2⅓ inches wide—this vessel is 4 inches wide in the middle, and about 2⅓ inches high. Another small bowl or porringer has on both sides two knobs with two vertical holes in each; the diameter of this little vessel at the mouth is 3½ inches, at the bottom it is 2 inches, and the height is rather more than 1½ inch.

Most of these earthenware vessels have but one handle, the exceptions being a small bowl or saucer which has two, and the ollæ or pipkins which have none. The handles are generally large, the upper part is mostly fastened to the sides of the vessels, the cases are rare in which the top of the handle is attached to the brim; they are all vertical, the horizontal open part being oblong—there are only two cases in which they are longer than high, one with the open space much dilated, the other with it very narrow. There is only one specimen of a bowl with the handle horizontal, the open space being vertical.

The round vessels are the simplest, but even here there may be noticed a tendency to adapt the shape to a more convenient form; some may be seen with the handle rising at an angle and with a flat top; others rise at the top as if to afford a firmer hold for the thumb; sometimes they are narrowed at the top, forming plain knobs or blunt points, or they rise above the brims of the vessels, or the top becomes a real raised handle (*ansa mono-appendiculata*) or it is divided into a handle with two tubercles.

From these bituberculated handles we go on to others which are rather uncommon, viz., those with appendages, which may be called either bifid, bifurcated, horned, or crescent-shaped. I found five of these all made of the finest clay, and of a black shining colour; in one the appendage is narrow and bifurcates at the top into short horns, which leave a hollow in the middle; in a second the appendage is broader, the horns are further apart, and the hollow deeper. Others are drawn Plate CLXXII. figs. 5 and 6; the first is small and round, the upper appendage is longer, and becomes thicker, forming a hollow in the middle, and two tubercles, one at each extremity.

Although these earthenware vessels are in general coarse, plain, and unornamented, yet there is evidently a tendency to add lines or raised work on the bands running round some of the cups and bowls, in the shape of mammillated protuberances; in addition to the circular band. The double raised bands which run round the vessels are in some cases very singularly combined, as, for instance, Plate CLXXIII. fig. 2.

So far we have only spoken of the ornamentation by straight lines, a few examples shall now be brought forward of a somewhat different nature. Plate CLXXIII. fig. 3 shows a vessel bulged out in the middle, and having a thick wavy band running round it. Fig. 1 is a fragment showing that the ornamentation consists of two raised lines joining at the base, where there is a little oval eyelet, also a similar one above, at the termination of each of the straight lines.

Some of the ornaments consist of a chain of dots or points, such as that drawn Plate CLXXIV. fig. 2. These markings are connected with certain curious fragments made of coarse clay, but without grains of quartz, they are of an earthy or muddy colour, and are very slightly curved. Did these large and heavy fragments belong to huge vessels, or is it possible that they were the interior ornaments of the huts or of the fire-places? Very few are smoky or sooty, but when they are it is always on the convex side. The ornamentation is alike in all, and consists of round impressions or holes with raised margins, as large as peas, made in continuous lines placed in various directions—sometimes in parallel pairs, as in Plate CLXXIV. fig. 2—sometimes in a double row near the brim, as in Plate CLXXIV. fig. 1. Sometimes the ornamentation is still prettier, and the impressed lines are placed in the form of large alternating and symmetrical rhomboids, Plate CLXXIV. fig. 3.

These squares or rhombs are connected with a singular form of ornamentation, with which we will close the scanty series of the Fimon ornamentations; it may be seen on two specimens, one of which was found near Pascolone in the excavation of 1864, the other near the Debba bridge in 1871. It consists of a small rhomb, surrounded by a larger one, placed so as to represent two triangles joined at the base, and with the two vertices opposite to each other, and from the lower apex and the sides near it, several straight lines take their origin. Plate CLXXIII. fig. 4.

One specimen was found of an irregular crescent shape, badly baked, reddish, mud-coloured, smoked, sooty, and broken. Numerous specimens of what are called 'spindle-whorls' were also found; they are round, like little wheels flattened, always perforated in the middle, and without any ornament; the colour is grey, earth-coloured, or blackish, some of them a little larger than a crown piece, while others are double or treble this size. All are of terra cotta, except one small one of stone.

There are numbers of vegetable and animal remains found in the relic bed, the piles themselves are chiefly of oak. The *Populus tremula*, the *Cornus mas* and the *Cornus sanguinea* are rarer. Several kinds of rushes and reeds were found and one fungus, but whether it was the *Polyporus fomentarius* or the *P. ignarius* could not be ascertained as the specimen was in bad condition.

The fruit of the *Trapa natans* was found here, and some few kernels of the wild cherry. Hazel-nuts were abundant, and so were acorns, some of them roasted and some adhering to the inside of the pipkins; also kernels of the *Cornus mas*, and seeds of the *Rubus fruticosus*, of the latter sometimes small heaps were found.

The fauna consists of few species, but the bones were very abundant, almost all the long bones had been split lengthwise. The bones of the *Cervus elaphus* and of the wild boar, *Sus scrofa ferus*, were found in immense quantities.

The *Sus scrofa palustris*, or peat boar, was found here, but the remains were by no means abundant, and the following may be mentioned amongst the animals, birds, and fishes, whose remains are rare at Fimon. The *Ovis aries palustris*, *Bos brachyceros*, *Cervus capreolus*, *Meles taxus*, *Anas boschas*, *Esox lucius*, and a large quantity of broken carapaces of a little freshwater turtle, *Emys lutraria* var.

Such are the remains found in the relic bed of the earliest inhabitants of the Lake of Fimon. How long these lake dwellings were inhabited who can say; but there came a time when the settlement was burnt, and all that remained were the charred tops of the piles and possibly some slight portion of the platform. The lake mud in process of years began to increase, and silted up the old relic bed, and gradually accumulated till it had deposited above it a mass of whitish clay, between two and three feet thick. It was then that the place became occupied by new inhabitants.

In the excavations which I commenced in 1871 near the bridge of Debba, in the neighbourhood of Pascolone, traces were found of these comparatively new abodes. Under the vegetable mould, at a depth of about 16 inches, there was a bed of clay which varied in thickness according to the different inclination of the bottom (it was on the average about 14 inches); below this was the later 'relic bed,' nearly 8 inches in thickness, then came the lake clay again, which was about 28 inches thick, below which was the old relic bed. The remains found in this upper relic bed, Plate CLXIX. fig. 2, No. 4, were different from those of the older and lower bed. In the earlier relic bed there were no traces of metal, but in the upper relic bed, now under consideration, I found a bronze celt, or rude hatchet, Plate CLXXVI. figs. 1, 2, and 3. Flint chips are rare; the dark blue kind was no longer used, but instead of it the grey, reddish, and yellowish varieties were employed. No stone implements were found, nor any arrow-heads. Wooden utensils, as usual, were wanting, with the sole exception of one large cup hollowed out of the knots of a branch, which fell to pieces on exposure to the air.

Pieces of pottery were not plentiful: those which were found were very different from the pottery of the lower relic bed. They were made of finer clay—the grains of sand mixed with it were few—the vessels, in general, were more baked, and probably made with the potter's wheel, or at any rate, with more accuracy. Some large vessels had the rim slightly thickened or curved, with one or two perforations in the margin. I found few handles, and none of them crescent-shaped or bifurcated—one rises up till it is bent back at a very acute angle to form the top, which is curved downwards so much that it has to rise again to be joined to the brim of the vessel—another handle rises from near the top of the side and then is bent down again to the brim. One handle is ornamented by a ring near the top, Plate CLXXV. fig. 1. This vessel has the mouth widened as the lip is curved outwards. It is ornamented with a raised band round it, and by a series of straight lines, below which are others of a zigzag form, made by a number of small indentations. The sides of another bulging vessel are ornamented by a series of zigzags, from the lower apices of which hang rhomboidal figures, Plate CLXXV. fig. 2. The spindle-whorls of terra cotta, so common in the lower relic bed, are wanting here, but I found a large ring of coarse clay of an earthy colour and badly baked, Plate CLXXVI. fig. 4.

The fauna had decidedly changed; the new inhabitants found it no longer necessary to hunt the wild animals, as they lived on those which were domesticated. The stags had disappeared, or become so rare that I could find no trace of them —it is doubtful whether the wild boar then existed in these parts, if so, it must have been small; some few bones were found which may have belonged either to the peat hog or to a variety of the domestic swine. The remains of sheep and oxen are common; both of them were of small size, but the skulls and horns are not found. The bones are not hard, nor have they a bright, glassy appearance, but are blackish, rotten, and soft; they are rarely split lengthwise, but are so broken and chipped that it is difficult to distinguish the species. There were no remains of other mammals, and none of birds or fishes, and no carapaces of the *Emys lutraria*. The only vegetables found were hazel-nuts, cornel cherries, and acorns.

CASTIONE AND THE MARL-PITS OR TERRAMARA BEDS.

In the provinces of Parma, Reggio, and Modena, there are to be found in many places considerable beds of a yellow-brown or brownish-black earth rich in animal substances and used for agricultural purposes. This earth is commonly called *marl*[1] (mergel, marna, &c.), but by Venturi it is named *burial earth* (terra cimiteriale).

In these marl-pits are found antiquities of various dates—pottery, implements, and coins, &c., of the Roman period; weapons, implements, and pottery of an early period; and lastly, human bones, as well as those of oxen, stags, and pigs, all mixed up in abundance with ashes of charcoal and burnt corn.

Venturi classes these beds which he calls 'burial earth' under three divisions. The first, according to him, contains traces of the burial-places where the Boii, a Gallic race, laid their warriors who had fallen in battle, or the relics of cremations and sacrifices of that age; the second contains remains of Roman graves; while the third exhibits those of ancient buildings destroyed by fire or some other calamity. The account of one of these dwellings, that of Castione, shall be given nearly in the words of the antiquaries who discovered it.

Cavedone, in his description of a sword found in the marl-pit of Marano (Indicatore Modenese, anno II. n. 18), partly agrees with Venturi's opinion; but he directs attention to the fact that different layers are clearly to be observed in the marl-pits, separated by beds of gravel, fragments of tile, and common earth. Neither of these gentlemen, however, have remarked one main point, and that is, that in by far the greater number of the marl-pits, the objects are not found as they were originally deposited, but where they were brought down by floods. For it has been ascertained that all the marl-pits in the above-named localities occur either in the neighbourhood of torrents or in places subject to the inundations of the Po.

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[1] The word 'marl' is here used for want of a better: but it must not be confounded with our English marl, the composition of which, it will be seen, is of a very different character.—[Tr.]

From information obtained in various quarters as to these singular deposits, it may be asserted that the greater part of the marl-pits contain the remnants of Roman graves and also the remains of interments, of cremations, and perhaps the refuse of feasts of people of the bronze age.

Amongst the remains of Roman graves may be noted the fragments of tiles used for making the tombs containing sepulchral urns, also lamps, the objects called lachrymatories, coins, and a variety of implements belonging to this period, and other objects washed down into the marl-pits by floods, and, in some cases, found there in considerable quantities.

The remains of burials of the bronze age may be recognised by the bronze swords, lance-points, wedge-shaped celts, as well as those with shaft-flanges, arrow-heads, and fish-hooks: all of which are found together with stone weapons and tools, especially flint arrow-heads, the whole mixed with ashes, charcoal, and human bones; also with very roughly worked earthenware vessels, badly burnt, of a black or dark red colour, the material of which is mixed with quartz grains; and, lastly, with spindle-whorls of burnt clay generally found so abundantly with remains of the bronze age.

The opinion that the marl-pits contain the remains of the ancient inhabitants of the country is borne out not merely by the great mass of bones of oxen, stags, swine, &c., found in them, but chiefly by the fact that the long bones of the extremities are broken at one end, just in a similar way to the bones of the larger animal found in great abundance in the 'Kjökken-möddings' (see A. Morlot, *Études géologico-archéologiques*, Lausanne, 1860), and in the lake dwellings of Switzerland. These bones were evidently broken for the extraction of the marrow, just as the Greenlanders and Laplanders of the present day break the bones of the reindeer.

After these general remarks, it will be well to give nearly entire the report by Sig. L. Pigorini and Professor P. Strobel on the Terramara beds in general, and on the lake dwellings of Castione in particular. This report has been printed in the valuable work by Signor Gastaldi before referred to (*Nuovi cenni sugli oggetti di alta antichità trovati nelle torbiere e nelle marniere dell' Italia.* Torino, 1862, in-4to, with six lithographic plates and woodcuts).

We will begin this notice by giving our reasons for the adoption of the terms Terramara and Mariera for these singular deposits. The expressions used by some scientific people, Terramarna (marl earth), Marniera (marl-pit), Terra cimiteriale (grave earth), have given false ideas of its nature both at home and abroad in a mineralogical as well as an agricultural and archæological point of view. By marl (marna, marne, &c.) is always understood a limy substance naturally containing clay, that is, without artificial means, and which can be used for the (mineral) improvement of the soil, in fact for 'marling.' The Terramara full of works of human art may contain both clay and lime, or it may consist more or less of clay containing lime,[1] but these are not its distinctive characteristic component parts: on the contrary, the phosphates and the organic matter (which are wanting in the true marl) make this earth extremely valuable in agriculture; it is, however, exclusively used for the (organic) manuring of meadows; if put on arable land it burns up the seed.[2] The name of 'grave earth' is too exclusive, and gives a partial view: that is, it presupposes a mode of origin which is by no means admissible, at least, for the greater part of the localities named. Now our country people call this questionable earth Terramara, probably a corrupted form of the expression Terramarna, but possibly also the genuine ancient name; for Ghiozzi, in his treatise on Julia Fidentia,[3] says that the earth derived its name of Terra di mare (sea earth), because it was imagined, though incorrectly, to have been a deposit of the sea. However this may be, the expression is not newly coined, and it has the advantage of giving no false ideas; the

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[1] The following are the chemical analyses of this earth from two different places, made some years ago by Professor Truffi:—

Constituents of the earths.	From Casaroldo.	From Nocceto.
Clay	070·930	045·470
Carbonate of lime	022·020	013·960
Sand and other mineral detritus.	003·900	033·180
Organic matter	002·820	004·300
Phosphoric acid	000·180	000·240
Mineral materials soluble in water, and loss	1·050	2·850
	100·000	100·000

[2] A classical friend suggests whether the name for this bed may be derived from 'terra amara,' and he refers to Virgil, *Geor.* ii. 238.

> 'Salsa autem tellus, et quæ perhibetur amara,
> 'Frugibus infelix.'

The fact mentioned in the text of the terramara burning up the seed if used on arable land, seems to agree with 'frugibus infelix'; but I am informed that this derivation has been proposed, and is not accepted by the Italian antiquaries.—[TR.]

[3] Memorie Storiche sulla Fondazione della Città di Giulia Fidenza, Edizione 2ª, Borgo San Donnino, 1840.

authors of this report, therefore, have considered it better to give it a preference over the others, and they have ventured also to derive from it the word Mariera.

This report is divided into three parts. The first treats of the productions of human art; the second of the organic remains; and the last of the origin of the Mariere or terramara beds.

I. REMAINS OF HUMAN INDUSTRY.

Amongst these the most interesting are certainly the pile dwellings. That we are now about to describe was found near the small convent of Castione, in the district of Borgo San Donnino, in the province of Parma. The part of it hitherto exposed is about nine-tenths of an English acre, but it probably extends over the whole area of the little hill standing there, containing about five acres or the greater part of it. In order to gain as good an idea as possible of the dwelling, and of the terramara resting upon it like a little hillock, let us imagine a little hill about ten feet high rising out of a plain, and surmounted by a kind of cloister castle, an ancient monastery (conventino). The top of this rise is formed of vegetable mould, below this is found the terramara, and the piles are met with underneath. If we imagine a vertical section, taken diagonally, of this hill and the ground below it, down to the points of the piles, it would approximately be as follows :—

1. Alluvial earth	6 ft. 6 in.
2. Terramara	8 ft. 1 in. (see *d*, Pl. LX. fig. 1).
3. Black peaty marl earth, or marly peat earth, formerly a marsh	3 ft. 3 in. (see *e*, ditto).
4. Greenish-grey clay marl, the ancient bed of the marsh	(see *f*, ditto).

The beds, Nos. 1 and 2, naturally diminish in thickness as the hillock slopes off all round towards the plain. The piles, for the greater part of their length, are in the third bed; on the average their heads or upper ends are about three feet below the level of the plain, and the terramara goes down to about five feet below it, so that it lies partly above and partly below the level of the plain. The piles are driven more or less deeply into the marl-bed, and at the present moment bend towards the east-north-east in consequence of a pressure coming from the west-south-west, probably from the terramara beds lying above. They stand, some singly, some in groups of three together, and at very various distances, Plate CXII. figs. 1 to 5; they are from 7 to 10 feet long, and their diameter at the top is from 4½ to 7 inches. On the piles are laid the beams, from 7 to 10 feet long; they lie at different distances from each other, according to the length and breadth of the dwellings, and join each other at right angles. Some simply rest on the piles or the beams on which they join, others are either let into a mortise, or furrow, cut into the head of the pile, or are forced through a square hole cut under the head. On this scaffold of beams lies the board flooring, made of a single layer of boards, 6½ feet long, from 6 to 13 inches broad, and from 1¼ to 1½ inch thick, fig. 3. Lastly, on the whole is the actual plaster flooring, consisting of a bed of yellowish clay marl (perhaps taken from the ancient bed of the marsh), about one foot thick; the upper surface is smooth and tolerably firm, probably made so by being beaten, or by means of fire. Towards the top there appear regular layers of gravel and clay, as shown Fig. 2, *a* and *b*, and below this at *c*, is a thin bed of decayed and charred wood. As yet no certain indications of the plan of the huts themselves have been found; it may have been that they were burnt down, for traces of fire are very evident. The piles appear to have been sharpened entirely with the celt or axe, and not by means of fire. The stems were not split, but used whole; they are chiefly trunks of elm and oak. Unfortunately the greater part of the dwelling which had been exposed after the terramara had been carted away, was again covered with agricultural earth and sown with maize. Only the portion lately excavated, containing about 420 square feet, and about 7 feet deep, could be taken under consideration, and the results of this excavation alone are here brought forward.

As in the Swiss lake dwellings, some remains of the walls of the huts have been found in the Mariere, in the shape of pieces of half-burnt clay, with impressions of wattlework; these evidently formed the covering of the walls, and probably belonged to those parts nearest the hearth, as the fire had burnt the clay; the other parts of the huts not having been burnt have probably decayed away. Pieces of plaster flooring, like that of the lake dwelling just described, were found in the terramara. A very singular hearthstone was lately discovered, Plate CXII. fig. 6; it is of unwashed clay, like that of the great spindle-whorls, and what have been called the 'fire cones' of the Swiss lake dwellings, not yet found in this district, and like them it has been worked without any particular care. Small holes have been bored in a row along the edges of the two larger surfaces, which, at least in some cases, reach through the hearthstone. On one of the surfaces slag-like blisters may be noticed, so that this stone has been exposed to a very strong fire, and there may be a question whether it belonged to an oven for baking, or to a smelting furnace.

Fragments of what are called Celtic vessels are dug out of the Mariere by thousands ; some of the smaller ones are entire. The largest yet found is about 5¾ inches high, and its greatest diameter is 7 inches ; it is of a spherical form with five knobs placed around the bulge, Plate CXII. fig. 7. The very large vessels, of which hitherto only fragments of various sizes have been found, had somewhat of a conical form, but with a bulge below, and usually had either vertical or horizontal handles. The smaller vessels varied very much in shape : some were like our dishes, cups, basins, or flower vases ; others resembled bowls, saucers, &c. ; and some of them, in spite of the rough workmanship, were not without ornament, Plate CXII. figs. 7, 8, 9, 10, and Plate CXIII. figs. 1 and 2. It is very singular that in Casola, a small town in the Apennines of Parma, earthenware vessels are still manufactured, resembling the simple ordinary earthen vessels found in the Mariere, both in the material, which is clay mixed with half-burnt limestone, or 'tarso,' and also in shape, and which likewise have neither been turned on the wheel nor burnt in a furnace. They stand the fire better than the usual earthenware vessels, and consequently find a ready sale in the neighbourhood.

Some of the vessels of the terramara have no handle, nor anything which would supply its place : others are ornamented with five or six little knobs round the bulge, and in several instances one of these knobs has a hole through it, by which the vessel could be hung up, Plate CXII. fig. 7. In some of those without knobs, a hole near the edge may be noticed, evidently for the same purpose, or one or two little ears, Plate CXII. fig. 9, like the vessels just mentioned from Casola. But a large proportion have regular handles, in fact, the ancient potters of the terramara, contrary to the custom of the Swiss lake-settlers, seem to have exercised their fancy and developed their art chiefly upon these parts of their vessels ; and, for this reason, it may be advisable to examine the matter a little more closely. The appendages (*ansæ appendiculatæ*) attached to the tops of many of the handles especially, are of the most varied forms, Plate CXIII. figs. 3 to 10. Sometimes they represent two stag's horns joined together at the bottom, or one of the shape of

Fig. 3 (*ansa cornuta*); sometimes a half-moon (*ansa lunata*), Fig. 4; sometimes they have the form of hare's ears (*ansa lagotis*), Fig. 5; sometimes of two curls opposite to each other (*ansa cincinnata*), Fig. 8; sometimes they take the form of lancet-shaped leaves (*ansa lanceolata*), Fig. 9; and there are sometimes two knobs, more or less developed, one on each side (*ansa bituberculata*), Fig. 6; or they form a cross-piece on the appendage (*ansa transverse appendiculata*), Fig. 7. In many cases there is only one appendage to the top of the handle (*ansa mono-appendiculata*), as shown in Fig. 10.

Amongst the various rims or borders of the vessels, a few deserve mention which, like many of those from the Swiss lake dwellings, evidently bear impressions of the potter's fingers; others with the edges turned up are ornamented with engraved lines. The greater part of the vessels have no projecting foot; the bottom itself, being generally flat, answers the same purpose. The ornamentation, though simple, and for the most part in straight lines, is not without taste, in many cases engraved, sometimes also inlaid with bronze, Plate CXIII. fig. 12, frequently marked with hemispherical impressions, and in many cases raised up like a cord, Plate CXII. fig. 8, and Plate CXIII. figs. 6 to 8, and 10 to 14. We must not forget to mention that the Mariere men had jugs with spouts nearly like ours. In the clay itself is sometimes found (as in the Casola vessels) powdered rhomboidal calcareous spar, the tarso of the potters of that town.

Several implements of wood have lately been obtained from Castione; they are drawn Plate CXIV. figs. 5 and 6, and Plate CXVI. figs. 1 to 11, and consist of haftings of awls, paalstab-shafts, shovels, pegs, and spatulæ; there is also a ring both in shape and size similar to the common supports of the earthen vessels; many other wooden things were found, amongst which are the remains of four baskets. The stone implements are not numerous; one single chisel has been found of touchstone or the hard jasper of the lapidaries, a flint saw, several mealing-stones, some of which were of talcose slate containing garnets, a kind of rock not found in the district of Via Æmilia but in the Western Alps; and, lastly, some worked stones of porphyry, Plate CXI. fig. 8; syenite and limestone, in form resembling the weights for the nets or for the loom, or corn-crushers, or the objects known under the name of slingstones. The bronze objects found in the terramara consist of pins, awls, or pointed instruments, styles, chisels, hoops, sickles (Plate CXIV. figs. 3

to 6, 10, 16, and 17). Many interesting objects are dug up of bone and horn, such as horns cut into pieces, the ends of horn polished, and in some cases with holes bored through; spatulæ, and small chisels, probably for shaping the earthenware vessels and engraving the ornaments upon them; pegs like those of a violin, most of them with a hole through the head; curved pins, like saddlers' pins, made out of split horns; handles of awls, daggers, and other tools, ornamented with engraved designs; and, lastly, some little wheels with 4, 6, or 8 spokes, in some cases with a second hoop between the nave and the rim, Plate CXIV. figs. 7, 8, 9, 11, 12, 13, 15, 26, 27, and Plate CXV. figs. 11, 13, 14. Lastly, several rough instruments have lately been found at Castione, such as the fibulæ of the swine, and the metatarsal bones of the stag, sharpened at the upper end and bored through at the lower extremity, the horns and ulnæ of stags made sharp, small double-pointed tools and hammers made of stag's horn.

Amongst the personal ornaments there are fossil shells from the Pleiocene beds, washed down from the Apennines, which have been ground and perforated by the drill or swivel, and then ranged on a string;[1] two neat combs of bone, Plate CXV. figs. 6 and 15, and one of bronze, Fig. 7; hairpins and other bronze ornaments, Plate CXIV. figs. 1, 2, 21 to 23. The objects drawn Plate CXIV. figs. 14 and 18, have a great resemblance to the crescent ornaments found in the Lake of Bienne and Neuchâtel.

Very few bone weapons have hitherto been found: in fact, the greater part are coarsely-worked arrows and javelin-heads, Plate CXIV. figs. 20, 24, 25, 28 to 30. One of the latter, which was four-cornered, was found still sticking in a part of the shaft, fig. 29, and in another the asphalt cement still adhered to the lower part. Flint arrow-heads are very rare in the Mariere; only one stone celt has hitherto been dug up in them, and it bears traces of having been rolled. In the museums of the Æmilian district there are a good many, but none of them have any note attached giving the localities where they came from, or they are only mentioned as 'found in the Apennines;' it seems, therefore, probable that in this country the antiquities of the stone age are to be sought for in these hills. The country people call the stone celts by the name of 'thunderbolts' (*pietre del fulmine*).

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[1] Fossil shells from the Meiocene beds of the Garonne, perforated by the hand of man, and evidently brought there as personal ornaments, were found in the Caverns of Bruniquel, and the Dordogne in France, see *Reliquiæ Aquitanicæ*, pp. 70, 179, 294, &c.—[Tr.]

The majority of the weapons are made of bronze, and, at any rate, a part of them, as, for instance, the dagger blades and combs, have been cast on the spot, for the slag and moulds have been dug up with them, Plate CXV. figs. 8, 9, and 10. The blades, which are of very varied forms, are the most numerous amongst the weapons, Plate CXV. figs. 1 to 5, and Plate CXI. fig. 4, after which come the paalstabs and the small hand hatchets of many different forms, Plate CXI. figs. 1, 2, 3, 5, and 6 ; not a single celt of the regular shape has yet been found. The arrow-heads are not abundant, Plate CXIV. fig. 19; the lance-points are still more rare, Plate CXV. fig. 12. A mould made of talcose slate for casting lance-heads of bronze has been discovered in a marl-pit in the district near Reggio. A kind of knife, like one found at Estavayer, Plate XCVI. fig. 3, and an arrow-head, are the only iron weapons which have been dug up in the Mariere, and it is not quite certain whether they actually belong to the same period as the other weapons, or have been mixed with them by accident in later times; this, however, seems hardly likely, as a large quantity of iron slag or dross has been found in the same place.

Spindle-whorls and rings of various sizes and shapes are found in abundance in the Mariere. The largest ring, which is made of clay, is about six inches across, and weighs nearly five pounds English. Some of the spindle-whorls are like fossil nummulites, others are spherical, nipple-shaped, or conical; most of them are plain, but some are keeled or ornamented with engraved lines, either straight or curved. Nearly all of them are made of clay, Plate CXVI. figs. 12 to 16, a few of them are of soap-stone or stag's horn, Fig. 17, and single specimens have been found of limestone and of amber. The little spindle-whorls of limestone and stag's horn are smoothed or polished. One little clay spindle-whorl has the form of a six-rayed star, Fig. 18. A larger one of the same material is four-cornered, and in some of the same kind four engraved lines radiate crosswise from the central hole; the clay of which they were made, as in Switzerland, was very carelessly worked, and mixed with all sorts of heterogeneous matter. Plate CXI. fig. 7 is the sketch of a kind of cylinder very much contracted in the middle, and with one edge perforated with three holes: its use is unknown to me.

Little disks and balls of clay, Plate CXVI. fig. 19, are also found in the Mariere. To the antiquities just described we may add a beautiful mould for casting a comb, lately discovered; a drawing of it is given, Plate CXI. fig. 9.

II. ORGANIC REMAINS.

The organic remains which hitherto have remained entirely unnoticed are of no less importance to science than the productions of human industry.

Of late years human skeletons have been dug up out of the Mariere, but, unfortunately, they were broken to pieces and dispersed: a radius is all that can now be found. It belonged to a skeleton which was discovered above the lake dwelling of Castione, buried with others in a horizontal position. This bone weighs nearly two English ounces, and is 9½ inches in length. The man to whom it belonged must consequently have been approximately 5 feet 6 inches high.

The majority of the mammalian bones are imperfect, with the exception of the bones of the extremities. There is hardly a bone of the cranium which is perfect, and very few of those found can be recognised in the terramara beds. No whole skull has yet been discovered. Hardly any of the bones of the face are uninjured, and very few of them are found, with the exception of the jaw-bones. The mandibular portion of the lower jaw is almost always separated from the condyles, which are broken off at the end of the alveolar portion. Only dogs' jaws have as yet been found whole. The cylindrical bones, such as the humerus, the femur, and the tibia, are almost always broken in two, either across or lengthwise. A large number found in the marl-pit of Ponte Nuovo were, with a single exception, broken off at one end. Of some animals, as, for instance, the stag, very few bones have been found, as they could be used for handicraft purposes. It may be further remarked, that bones of all kinds lay mixed confusedly together, just as they might have been thrown after having been used for food or industrial purposes.

The bones of domestic animals, especially of the cow and the pig, undoubtedly are found in greater numbers than those of wild animals; it was only now and then that one of the latter sort fell into the hands of the settlers of the Mariere, as, for instance, the bear.

It appears that they possessed only one race of dogs, which probably was nearly the same as the marsh dog, if, indeed, it was not identical, differing only in being somewhat smaller. Nearly all the lower jaws which have been found have the same characters both as to teeth and bone. Not a single bone of the cranium has yet been found, and very few bones of the extremities, only a humerus and ulna; a shoulder-bone and a pelvis were also dug up.

The remains of two races of pigs are found in the Mariere—the domestic and the marsh swine; those of the first are not abundant, while at the present day it is the only breed kept in the country.

Very few remains of horses are found in the terramara, and apparently not at all in the lowest beds. They belong to two breeds—one smaller, more finely formed, better bred, and more ancient; and the other larger, heavier, and more recent. Bones of the ass are only found in the upper beds, and even then there is some doubt about them.

As already mentioned, most of the bones belong to the cow, of which those of the smaller breed, the marsh cow, and a still smaller variety, are the most common; and those of the larger or the common ox are more rare. Many bones of the face, belonging to the first, were found, and pieces of epiphyses of the others. The marsh cow has now disappeared from the district of the Mariere.

The goats of the terramara appear to have been somewhat smaller than those of the present day.

Only a few sheep's bones were found, and they nearly all belong to the marsh sheep. Occasionally, perhaps, in the later settlements, the remains of a larger breed are met with.

All the bones of wild animals found belonged to five species only: this number will doubtless be increased in time, when more attention is paid to the remains of smaller animals.

Most of the antlers are those of the stag, but of a large variety, which exceeds that of the present day in size, and stands between it and the *Cervus megaceros*; both the main branch and the offshoots are flattened at the top of the horn. The bones of the cranium appear in this species to have been broken open as if by other animals. The inhabitants of the Swiss lake dwellings, on the other hand, opened skulls of this kind by separating the squamous portions of the temporal bones.

The roebuck of the terramara does not seem to differ at all from that of the present day.

But few remains of the wild boar have as yet been dug up. The finest and best preserved specimens were found lately in the peat, underlying the terramara, at Castione. There are two lower jaws, almost perfect; one of them is that of a very old male animal, with the alveolus of the first premolar closed;

it is a little larger than that drawn by Prof. Rütimeyer. Both of these lower jaws have a wide round hole in the middle of the upright ramus, and one of them has still a piece of wood sticking in it, probably the remains of the staff or the lance-shaft on which they had been hung as trophies. Further excavations will show whether the wild boar was a common animal in the time of the Mariere. Probably the marshy nature of the land may have been favourable to the wild boars, by keeping the bears at a distance, the remains of which are only here and there met with in the terramara beds, as they probably were only to be obtained by the inhabitants when hunting in the Apennines. Only one tusk of this predacious animal has been found: a fact which corroborates this opinion. The imperfect skeleton of a water-vole was lately found at Castione; and this closes the list of mammalia.

The terramara, up to the present time, has yielded but few birds' bones; only some of the hen and of the common, or perhaps the wild, duck. No trace was found either of amphibious animals or fishes.

The remains of molluscous animals abound in every locality; they are simply of species which at the present day live in water or on land, in the plains of the Po or on the hills of the Apennines: such as *Cyclas* sp. (?), *Unio pictorum*, *Alasmodonta compressa*, *Anodonta* sp. (?), *Paludina vivipara* and *Achatina*, *Limnea peregra*, *minuta*, *stagnalis*, which are mollusca living in fresh water; *Zonites Draparnaudi*, *Helix Carthusianella*, *fruticum*, *hispida*, *candidula*, *Ammonis*, and *nemoralis*, which live on the plain; *Helix Etrusca* and *lucorum*, *Cyclostoma elegans*, now living at the foot of the hills; *Zonites Leopoldianus* and *Helix obvoluta*, which are found living on the mountains. The shells of the hills were evidently washed down by the streams and deposited with the freshwater shells of the Po at the periodical inundation of this river, or possibly they were brought here in mud by the settlers of the Mariere.

The remains of plants from the terramara have been but little studied: more attention has been given to those found in the peat earth lying below it at Castione. The remains of food or stores of provisions are frequently met with, such as corn (*Triticum turgidum*), hazel-nuts, pears and apples, sloes, cornel cherries, and pistachio-nuts (*Staphylea pinnata*), and also different kinds of acorns. All these were chiefly found in a burnt condition. Beans are said to have been found also in this state in abundance like corn. There is plenty of linseed to be met with. Cord of two strands, nets and woven cloth, all made of flax, were found here. The piles for the lake dwellings were hewn out of the trunks of oak, elm, and chestnut trees. Many seeds and fruits, and some kinds of moss and fungi (*Polyporus Dædalea*) are yet undetermined.

The marsh pig, the marsh cow, and the marsh sheep, amongst the domesticated animals, and the red deer, the roebuck, and the wild boar, amongst the wild animals, have disappeared from the region of the terramara beds; in fact, the latter did so in the later historic period. This is the chief difference which as yet we have been able to observe between the fauna of the Mariere and that of the present day.

III. ORIGIN OF THE TERRAMARA OR MARIERA BEDS.

Different opinions have been expressed by several authors as to the origin of these beds: amongst them are Venturi, Cavedoni, Ricci, Ghiozzi, and Mariotti, although none of them have paid any particular attention to these deposits. Gastaldi was the first who published a special treatise upon them,[1] in which there is a notice of these different opinions. The conclusion arrived at by the authors of this report, guided simply by facts, such as the composition of the beds, the objects found in them, and the nature of the localities, is that this deposit is the accumulation of various kinds of refuse either of the kitchen or of manufacture, or possibly of sacrificial rites left by several settlements of the pre-Roman inhabitants of Upper Italy; these remains are proofs of various settlements which continued for a greater or less period of time. The nation was partly nomadic, such as shepherds and hunters, and partly stationary, such as fishermen and agriculturists. Many of these accumulations still remain on the very spot where they had been deposited; others have, in later times, been worn away and undermined by the rain, by streams, or by the Po, or possibly have been washed away still further. Those first mentioned are distinguished by their containing in their original state horizontal beds of ashes and charcoal, with a slight curve, as well as by the remains of lake dwellings, and fragments of pottery, with the fractured edges sharply defined, which are found in them. The earth is clearer, more chalky, lighter, contains more nitrogen, and affords a manure of the first quality. The terramara which has been washed down contains no particular trace of ashes, the charcoal is not in beds but dispersed, and is often entirely wanting; the objects found in it are worn or rolled, the earth is darker, more argillaceous, and contains less nitrogen, so that a good deal of it cannot be used for manure, as it does not pay the expense of excavating and carriage.

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[1] Cenni su alcune armi di pietra e di bronzo trovate nell' Imolese, nella marniere del Modenese e del Parmigiano, &c. (Atti della Società Italiana di Scienze Naturali in Milano, 1861.)

The accumulated terramara beds chiefly appear as slight elevations gently rising in the plain from the Po to the Apennines; but only in the provinces of Parma and Modena, no similar beds have yet been found elsewhere. In later times, the Romans, the Longobardi, and other inhabitants of the district, making use of these localities by preference, built villas and farms, castles and monasteries on these rises, and thus objects are frequently dug up in the Mariere (though in the original beds only towards the surface) belonging to these later inhabitants; such remains, therefore, are totally distinct from the actual and characteristic component parts of the deposit, and are of no account in the investigation of the terramara.

The weapons and tools found in these beds, as originally accumulated, nearly all belong to the bronze age. Stone celts, with other weapons and tools, are found, though not plentifully, in the Apennines;[1] it appears, therefore, probable that the hills were inhabited before the marshy plain, even in the stone age, but that the plain itself was first made habitable in the bronze period.

In spite of some trifling differences, all the weapons, the tools, the lake dwellings, and even the breeds of domestic animals, indicate a relationship between the inhabitants of the Mariere and the lake dwellings of Upper Italy with the settlers of the lake dwellings of Switzerland and the Tyrol, especially of the bronze age. Implements have also been found, such as meal-stones of talcose slate, with garnets, a kind of rock which is not found in the Apennines, its nearest locality being in the Alps. From these facts we might infer that the inhabitants of the Mariere pressed forward from the Alps into the plain of the Po in the bronze period, or at the very end of the stone age, bringing with them these implements, which, after having become unserviceable, were exchanged for others of the kinds of rock found in the Apennines.

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[1] Photographic drawings of these stone objects, by Professor Brigidini of Piacenza, are to accompany the account which will shortly be published on the excavation of the walls of the Ligurian city Umbria, by Messrs. Wolf and Pallastrelli.

Whether the settlers of the Mariere (as the authors of this report conclude with some reserve) were Celts, in fact Gauls, or more especially Boii, must be left to be decided by further more extensive and careful excavations, and by a more complete examination of these singular deposits.

It may be remarked in conclusion, that amongst the objects drawn, many are precisely similar to specimens in the collection of the late Colonel Schwab from the Lakes of Bienne and Neuchâtel.

EARLY ANTIQUITIES FOUND IN ITALY, ETC., ILLUSTRATIVE OF THE IMPLEMENTS AND WEAPONS FROM THE LAKE DWELLINGS.

As it is only by careful comparison that we can at all hope to arrive at truth in antiquarian research, it may be advisable here, in as few words as possible, to collect some notices of early antiquities found in Italy, not in lake dwellings, but on the main land; they may illustrate the manner of life amongst some, at least, of the lake settlers, and may possibly indicate a relationship amongst tribes widely spread over a large extent of country.

Only a few instances can now be given—still they may be of interest. We will begin with the most easterly.

The discovery made by M. Forel, the president of the 'Société d'Histoire de la Suisse romande,' is of great interest.[1] He has found in the caves of Mentone near Nice, stone implements, together with bones of different kinds of animals.

Large quantities of charcoal and ashes, with stone weapons and tools have been found at Brescia.

In the museum at Parma there is a series of earthenware vessels found in the neighbourhood, which are exactly like those of Mercurago and San Martino, both in execution and material.

At a place called Cumarola, a few miles from Modena, forty skeletons were discovered in 1856, simply buried in the earth three feet deep, and lying in two rows. Professor Cavedoni has given a complete and detailed report of this discovery in the Messaggiere di Modena.[2]

Each of these skeletons had on the right side, turned upwards, a socketed lance-head of copper, probably mixed with a little tin, and on the left a flint arrow-head. Besides these, some had on the right side a wedge-shaped lance-point, others a similar weapon of very hard serpentine, and others, again, had above the head a perforated stone celt, likewise of serpentine. One of these skeletons was distinguished from the rest by having on the right side a large well-worked lance, and above the head a cylinder (tubo) of bronze.[1] Some skeletons had previously been found in the same place in 1773; the implements found with them are preserved in the museum of the Royal University: one of them is of dark green serpentine, and has the form of a half-moon, and on the concave side a flat appendage that might be put into the cleft end of the shaft, Plate CXVII. fig. 3. Figs. 5 and 6 are also of serpentine; figs. 4, 7, 8, 9 are flint arrow-heads; fig. 10 is of clay; and figs. 11, 12, 13, and 14 are of bronze.

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[1] Forel, 'Notice sur les Instrumens en Silex et les Ossemens trouvés dans les Cavernes de Menton.'

[2] Ragguaglio archeologico intorno allo scoprimento di un antico poliandrio o sia tumolo sepolcrale di circa xl guerrieri colle loro armi. (Messaggiere di Modena, 24 Dicembre, 1856, no. 1486.)

Count Gozzadini has added most materially to our knowledge of the civilisation of the bronze age in Italy by his report on the Etruscan tombs discovered on his estate of Villanova, near Bologna.[2] It is evident that these graves belong to a later age than the burials of the bodies at Cumarola, and they are also later than the lake dwellings of Mercurago; and yet the objects of these three localities, as well as of those previously mentioned, decidedly seem connected in many respects. If we carefully examine the beautiful plates given in Count Gozzadini's report, and compare the objects found at Villanova with those of the Swiss lake dwellings, and with those of Mercurago, and also with the antiquities of Sesto Calende, drawn Plate CXVII. figs. 15, 16, 17, 18, 19, and 20, we may observe a striking similarity in the forms of the objects, but more especially in their mode of ornamentation by lines and dots.

A large number of weapons of the stone age were found by Mr. J. Cerchiari, on a spur of the Apennines, near Imola, in the parish of Goccianello, figs. 21, 22, 23, 24, and 25. With the single exception of one specimen in bone, they consist entirely of objects made out of pebbles. Dr. Scarabelli, a well-known geologist, has described them in the 'Annali delle Scienze Naturali di Bologna,' in 1850. There are in all thirty heads of lances and arrows, and two stone celts. Of the lance and arrow-heads some are only just shaped out of the rough material, while others, on the contrary, are neatly finished. The fact that one of these lance-points was found near a heap of flint fragments, and that the greater part of these weapons consist of the flint of the district, lead to the conclusion that they were manufactured on the spot. Some time afterwards other things were found on the same place, such as perforated clay balls, little millstones of talcose slate with garnets, such as that found in the vale of Aosta, and an extraordinarily fine perforated celt of diorite, and also three other beautifully-worked celts of very hard stone.

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[1] This object is of bronze and not of iron, as was believed at first.

[2] Di un sepolcreto etrusco scoperto presso Bologna, descrizione del conte Giovanni Gozzadini. Bologna, 1855. Also, Intorno ad altre settantuna tombe del sepolcreto etrusco scoperto presso a Bologna e per far seguito alla descrizione già pubblicata nei cenni del conte Giovanni Gozzadini. Bologna, 1856.

Arrow-heads, axes, knives, &c., made out of volcanic rock, have been found, together with bones of the stag and the swine, by Baron Anca, in some of the Sicilian caves,[1] and stone weapons, especially arrow-heads, have been found at Ancona. The country people pick them up and wear them as charms against lightning. The same belief, according to Mr. Nicolucci, prevails in the neighbourhood of Naples.

All these reports of stone implements having been found in different parts of Italy, the south of France, and even Greece, satisfactorily prove that the south of Europe has passed through its stone age in the same manner as the north of Europe, but probably at a much earlier period.

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[1] Bulletin de la Société Géologique de France, 1860.

TERRAMARA OF SENIGA.

By Dr. Camillo Marinoni.

A very interesting paper was read by Dr. Marinoni to the Italian Society for Natural Sciences, on the 29th March, 1874, on the prehistoric remains of the district of Seniga, in the province of Brescia, and more especially on those found at Chiavichetto and Gottolengo. On some accounts this paper would hardly have come under our notice in the present volume, as neither piles nor any actual remains of the lake dwellings themselves have been discovered; but the antiquities found are so evidently those of the regular Terramare of other places, that it would not be right to omit some notice of it. It will, however, be very brief.

The little map at the top of Plate CCIV. is copied from one given by Dr. Marinoni, and will explain—perhaps better than words can do—that the district in question is situated at the confluence of the rivers Oglio and Mella. What appears in form almost as a reversed delta, is ground which at some time or other has evidently been formed by the materials brought down from the mountains by these two rivers, the lowest and still marshy portion being close to the confluence. But three separate terraces, one above the other (indicated in the map), seem to show that in very distant times this portion of land has undergone great changes, into the causes of which it would be foreign to our present purpose to enter.

The settlement of Chiavichetto is the one which is most interesting, and the soil here appears to be the regular terramara; by some mischance it has been omitted in the map CCIV., but it is a small place on the banks of the river Oglio. Other settlements have also yielded antiquities of various ages from the above period down to the Roman times,[1] but the beds do not appear to be exactly like those of the regular terramara. Of this kind are Cozzaghe, Formighere di Mattina, Chiosino, Castellacio e Pomello, Ca'del Dosso, Castelletti and Breda.

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[1] The mode in which antiquities of all ages seem to be mixed in the Terramara beds appears to me very strange. It is very difficult to imagine how this mixture could have taken place without the whole having been washed away and redeposited. But facts must be taken as they stand.—[Tr.]

A few of the antiquities found at Chiavichetto, and which are drawn on Plate CCIV., shall now be described.

Figs. 1 and 2 are flint arrow-heads.

Fig. 3 is a flint knife.

Figs. 4 and 5 are small flint knives.

Fig. 6, an earthenware vessel which originally had four knobs or handles.

Fig. 7, one of the crescent handles of a jug, so common in the terramara beds.

Fig. 8, fragment of a vessel made of fine clay, with coarse ornamentation.

Fig. 9, fragment of a vessel of fine pottery, ornamented apparently with three rows of coarse knobs.

PROFESSOR P. STROBEL ON THE ORIGIN OF THE TERRAMARA BEDS.[1]

In the conclusion of an article which I wrote in 1872,[2] on shells of a *Unio* found in the Mariere, &c., I asserted that the terramare, those prehistoric settlements, were *terrestrial*, that in some of them man lived in pile dwellings on dry ground, in others he dwelt in tents or huts; and that in some of the terramara beds, earthworks can be seen, which may have been used as dikes or bulwarks, and which in all probability were fortified with ditches.

The kindness of Professor D. G. Chierici has enabled me to be present at the excavations carried on by him at both of the terramare of Rotteglia, and by the courtesy of the Senator G. Scarabelli, I was able to see the excavations in the terramara of Castellaccio, near Imola; and thus I have noticed some facts which seem to bear out my previous assertion, and which appear to me worthy of being communicated to archæologists. One of the terramara beds of Rotteglia, and also that of Castellacio are situated on the quaternary terraces; the terramara beds of Rotteglia are in the valley of the Secchia, and near that stream, about 48 miles south-west of Modena. The other, that of Castellacio, on the right or southern bank of the Santerno, is about a mile and a half south of Imola. The little hill on which Rotteglia is situated is a continuation of the spur of the mountain on the left or western bank of the Secchia. The hill of Castellacio on the contrary stands out alone, and is one of those advanced 'outliers' with which the Apennines die out in the plain of Imola. If it be admitted, as some affirm, contrary to my opinion, that these stations existed in artificial pools of water, and that the different kinds of earth were deposited in the water beneath, we shall necessarily be driven to one of the following conclusions, viz.:—

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[1] From the 'Archivio dell' Antrop. e la Etnol,' vol. iv. Fasc. iii. and iv. As the object of the present work is to give as much information as possible respecting everything connected with lake dwellings, the above paper by Professor Strobel is inserted here, although very probably some antiquaries may differ from him. The paper is given nearly, but not completely entire. Some small portions have been omitted which did not seem to bear on the general question.—[Tr.]

[2] Archivio per l'Antropologia e la Etnologia: Firenze, vol. ii. Fasc. iii., p. 233.

Either that the origin of the terramara beds, and more especially those of the bronze age, goes back in any case to the quaternary epoch, or, to speak more precisely, to that of the terraces when the waters flowed at a level but little lower than that of the settlements in the mountains.[1]

Or, on the other hand, that the formation of the terraces took place in the present geological era, or more precisely, at a late prehistoric age, viz., that of bronze.

Or, lastly, that the inhabitants of these dwellings (who for convenience' sake I will call 'terramaricoli') were so skilful in mechanics and hydraulics as to be able to raise the neighbouring water from its level at that time up to the height of the settlements, which were at least from 50 to 65 feet above it, or else to bring it from a considerable distance by means of hydraulic works of which there is no trace,—an assumption of knowledge quite incompatible with the degree of civilisation which can be proved by the remains of that age now constantly found in our country.

Certainly these three suppositions are not impossible, but we cannot say that any one of them is probable. Besides, these settlements above mentioned are situated near streams: if the level of the water in these streams had been high enough to be available for the supply of the supposed pools, the settlements would have been continually liable to be inundated and destroyed. It is highly improbable that the settlers made choice of such dangerous localities for their abodes; we ought rather to admit that these habitations stood as high above the normal level of the water as that level was exceeded by the freshets. At such an elevation water could not have been obtained from these streams except by hydraulic works, which do not appear to have existed; hence it is more likely that the 'terramaricoli' inhabited dry land, and that at the age of the terramare the streams ran in channels about the height of their present level.

Four different materials or kinds of earth are found in the terramare, which may be distinguished in general by their strength, their nature, their contents, and their colour; these may all be seen in one section, either in undulating layers, not quite horizontal, nor perfectly parallel, nor continuous, or in patches of different colours. The true terramara, agriculturally speaking, is light, and consists of ashes with carbonaceous matter, pottery, and implements scattered amongst them. We should call it ash-coloured earth, from the prevailing colour. It is this which lies immediately on the original soil of the terramare, which is argillaceous, sandy, and of a clear colour in the plains, but argillaceous and of a darker colour in the piles, hence it is called '*Morone*.' Another kind of earth is of a yellowish green colour, arenaceous where the original soil is sandy, and argillaceous where it is clayey. A third kind of earth is calcareous, in colour reddish or whitish red; it is porous, light, like clay or baked loam (lehm), and contains baked pottery, now and then dross or refuse, and burnt bones. Lastly, the fourth kind of earth found in the terramare is of a brown colour, and is a product of the natural carbonisation or decomposition of vegetable bodies; this kind is always in thinner beds than the others, in fact, only a very few inches in thickness. In the terramara of Casaroldo in the plain of Parma, all these different kinds of earth may be seen; in that of Rotteglia, on the contrary, there is but little of the reddish earth. Their superposition, and their mode of deposition vary in different terramara beds. The brown earth, for example, in the terramara of Casaroldo is found between the ash-coloured and the reddish earth, or beneath the latter; while in that of Castellacio it is above them.

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[1] In order to make my arguments more clear, simple, and short, it is my intention in the following essay to refer only to those settlements which are situated on a hill, leaving entirely out of the question those which are found in the plain below.

In one section of the excavations the ash-coloured earth may be seen, as it were, leaning against the yellowish argillaceous earth, containing very little carbonaceous matter and but few pieces of pottery, in such a manner that the line of contact between them is almost vertical; this is a position which these materials could not have taken if they had been deposited in water. This section reminded me of that in the terramara of Castione lying above the pile dwelling drawn in fig. 2 of the second account of the terramare of the district of Parma;[1] it was then attempted to be proved that the earth which was there almost entirely destitute of refuse was analogous to the yellowish earth of Castellacio, and indicated the place which the huts had occupied, while the other or ash-coloured earth might be considered to match the space around them, into which the settlers threw all their dirt and refuse.

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[1] Strobel and Pigorini: Le terramare e la palafitte del Parmense. Seconda relazione, p. 15, Milano, 1861 (Atti della Soc. Ital. di Scien. Nat. vol. vii. p. 15).

In one of the sections of the terramara at Casaroldo, may be seen several beds of different kinds following each other in the form of the letter S standing upright—a position which they never could have taken, if deposited in water.

It appears from the above that the materials of the terramara beds were not deposited in layers, which must have been the case if they had been formed (*precipitati*) in a pool of water; on the contrary, they are arranged in beds, sometimes of a lenticular shape, as at Castellacio, which, when they follow each other closely, would in a section take the form of continuous and undulating layers, similar to those of stratification, and yet they are not truly stratified.

Besides, if the materials of the terramare had been deposited in pools of water they would, as I have elsewhere shown more fully (Archivio II. page 266), naturally have been like the moist earth of the lake dwellings of Castione and Parma which underlie the terramara.

On the whole, I conclude that the materials of the terramare were accumulated on *dry land*, as I have already explained in the above-mentioned work and in other memoirs.

In the terramara of Castellacio, a ditch was found about three feet wide, and nearly the same in depth, which was covered over by the ash-coloured terramara, and the upper two-thirds filled with it; the lower third part consisted of the dark earth (morone). It was full of pieces of pottery belonging to the terramaricoli, of bones,[1] and of soft loose earth which filled the empty spaces both in the former and the latter, like the earth which had filled up the vacancies left in the ground by the piles when they had decayed away. It was decidedly a hole dug by the terramaricoli, into which they threw their rubbish. I would ask, how could they possibly have dug such a hole beneath the water, and what motive could they have for doing so? Would it not have sufficed to throw their refuse into the water? Hence, I say, that the assumed pool of water never existed.

Professor Chierici has undoubtedly the credit of having discovered in the terramare, banks or causeways, and the traces of piles. Both (banks and traces of piles) were found in the terramara beds of Casaroldo and Rotteglia, and in that of Castellacio he discovered evidence of two piles; I am not aware that any remains of banks have yet been found there, but whether the traces of piles have been discovered or not, they would not prove the existence of a pool of water, for they may have belonged to a pile dwelling on dry land—nay, they would not even prove the existence of a pile dwelling, for up to the present time no traces of a platform have been discovered, nor of partition boards, and these few piles may possibly have had some other object, such as that of supporting the walls or the roofs of the huts, or as props or supports for the banks, as Professor Chierici with good reason considered, the piles being so very near them. The banks must have been raised not so much to form a pool of water as to be a protection from the winds or the waters, from animals, and from human foes. Professor Chierici has shown that the terramaricoli when forming the banks or bulwarks dug at the same time a ditch on the outer side. This ditch was probably at first excavated without any definite object, possibly without foreseeing the effect, but in fact it became a defence to the settlement.

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[1] Amongst these the jawbone of a beaver deserves especial mention, as it was of unusual size.

Thus, neither piles, nor banks, nor ditches, when found in the terramara beds, prove, apart from other evidence, that they had been placed or made in a pool of water.

In the terramara of the little hill of Rotteglia, single valves of the *Unio* were found which had been burnt, that is to say, deprived of the periostracon or epiflos. I do not consider that this fact is in favour of the hypothesis of a pool of water, for mixed with these freshwater shells were found land, marine, and fossil shells, sometimes whole and sometimes broken, and some of the two last-named had been bored by the hand of man. Besides the *Unio* does not live in the neighbourhood of Rotteglia, as there is very little either standing or running water there. It appears, therefore, that the inhabitants of the settlement at Rotteglia had come down to the plain where these shells were living in order to secure their booty. It certainly is not probable that they searched there for live *Unios* to place them in the supposed pool, and make a preserve of them, like our modern oyster-banks. For if such had been the case, we should have found in this terramara a much larger number of these shells. In describing these valves, I pointed out other reasons for thinking that the presence here of the Unio and other freshwater shells does not prove this settlement to have been made in water.

From these facts, then, we may conclude: That the terramara beds were not deposited in pools of water but on dry ground, by the combined agency of water and man.

As to the terramara beds on the heights, it appears to me that their formation may easily be explained by supposing that the refuse of husbandry and of the kitchen, the sweepings and rubbish of all kinds, the broken objects mixed with charcoal and ashes from the fires, were thrown away, and then became soaked and consolidated by refuse water from the settlement, or by rain. With respect to the earth which is sometimes reddish or reddish-white, and which forms part of the materials of the terramara, I am inclined to think that the reddish colour of the earth here, may indicate either the position of the household hearths, or of the fires used for melting metals.[1]

The greenish-yellow earth might have been either the remains of the floor made of the original earth of the terramara soil, or it may indicate the site of the huts.

Now, I do not think, for the reason above stated, that it has been proved that man lived in pile dwellings in the hill stations, and further, I think that the traces of piles as yet discovered are too few to indicate the remains of a lake dwelling, especially when compared with the large number of piles in the lake dwellings of Parma and Castione.

But though I do not consider the existence of pile dwellings in the terramara beds of the heights to be proved, yet I do not say it is impossible, and this is rendered more likely by the terramara beds of the plain. In my memoir (page 38, Archivio, page 270), I mentioned that the mode of living in pile dwellings, even on dry ground, was common to all times and nearly all races. Dr. E. de Marlens, referring to this work, stated in support of my assertion that the Dyaks of the island of Borneo still live in houses constructed in this manner.[2]

And here I may be permitted to raise my voice against those who imagine that prehistoric men, and more especially those of the Marière, and of our terramare and pile dwellings of the bronze age, always and everywhere followed constantly one uniform and invariable order in arranging their abodes, as if they were inferior to the animals, nay, even to the invertebrates, who modify their constructions according to circumstances. But, in fact, there is much less uniformity in these terramare than is often found in the dwellings of animals, therefore I maintain logically, that even prehistoric men changed their mode of living according to place, time, and circumstances; and that the terramaricoli did not live solely in pools of water, as some assert, but had settlements both in the water and on dry land, and that the terramara beds are the results of the latter. In some of the terrestrial settlements they probably had pile dwellings, while in others they lived in huts or tents. Some at least of the land settlements were defended by dikes and ditches.

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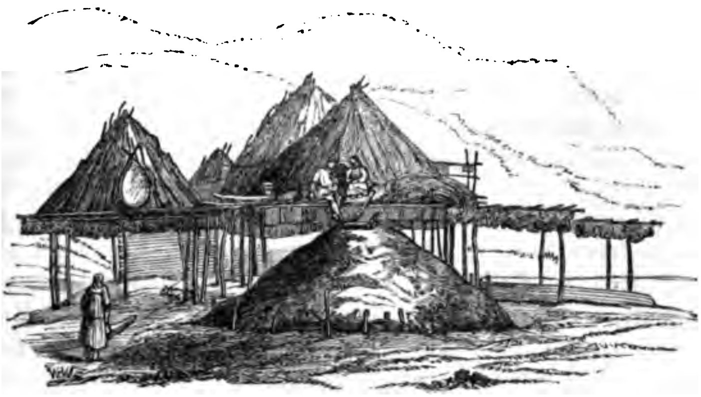
[1] At Casaroldo the earth is very red, and the pottery found is much burnt and the earth is much calcined, showing that there was once a foundry there. At Castellacio, on the other hand, where the space is very limited, the earth is but little red or burnt, and this is the sign of a household hearth.

[2] Captain Cook has described the summer and winter habitations of the Tschutski, in the extreme north-east of Asia (Kamtchatka). The winter lodge is like a vault, sunk below the surface; the summer lodge was raised above ground, built on a platform supported on poles.—'Voyages to the Pacific Ocean,' vol. ii. p. 450, and vol. iii. p. 374. The annexed woodcut (Fig. 28), is obligingly lent by Mr. Norgate, the publisher of Lubbock's 'Prehistoric Times,' 3rd edition, 1872, p. 132, fig. 141.

Are they descendants of a race of Lake-Dwellers, who now dwell on land, but still adhere to their pile-dwelling mode of architecture?—[Tr.]

Some persons imagine that every implement of this people and age could only have been intended for one purpose, and they are much puzzled to account for the few varieties found. But the shorter time which had elapsed since the infancy of the human race, the less would be the subdivision of labour, and the fewer the tools, which would therefore be put to many uses; precisely as in our own day, if we were to find ourselves in an uninhabited country with but few implements, we should be obliged to make them serve for many ends. Hence, I am of opinion, that most of the utensils from the terramara beds were, according to cirumstances, used for different purposes.

FIG. 28.



SUMMER AND WINTER DWELLINGS, KAMTCHATKA.

LAKES OF MONATE, ANNONE, SALA, AND PUSIANO.

Lake of Monate.—This lake was visited in April 1863, by MM. Stoppani, Desor, and Mortillet, but nothing was discovered at that time, and the depth of the water surrounded by perpendicular cliffs made them consider it an unlikely place in which to find lake dwellings. Notwithstanding this, during the winter of 1864, the Abate Ranchet discovered two pile settlements on the western bank (see Plate CLXV.), about 220 yards apart, just under Codrezzate. These two stations were both of the stone age; that to the east is about 400 feet long, and about 100 broad—the other does not cover half this area, and consists of enormous heaps of large pebbles, and masses of stone about 6 or 7 feet under the level of the water. Piles are not wanting there, however; they are of birch and in good preservation, and though not plentiful, yet they give sufficient evidence that this was a pile-dwelling.

But few antiquities have been found here: two flint arrow-heads of the common type; a small saw, fragments of worked flint and charcoal, and numerous remains of animal's bones, some split and others pointed. A very large quantity of pieces of pottery were also found, of finely worked clay mixed with shining fragments, much resembling that found in the Swiss lakes. Some of the smaller vessels appear to have belonged to a more advanced stage of civilisation, as the material is finer and the forms less primitive—Plate CLXIV. fig. 1, will give an idea of one of these: the dotted lines represent what its form would have been if perfect. These earthenware vessels appear not to have been regularly baked, but still, nearly all show some action of fire which blackened them, and within many of them there are still the remains of carbonised matter. A very large quantity of worked and unworked bones was found here.

On the whole, from all that we have seen there can be but little doubt that these two settlements were of the stone age.

Lake of Annone, see Plate CLXVI.—Professor Stoppani has discovered the remains of a lake dwelling, probably about 170 feet long in this lake; it runs parallel with a series of heaps of stones which are found in the channel connecting the two lakes of Sala and Annone (Plate CLXVI.); the depth of water is about 6 or 7 feet. The piles have decayed down nearly to the level of the bottom, and have all the appearance of the old piles of lake dwellings, but the bottom is peaty, and this prevented much exploration.

Lago di Pusiano.—Another settlement was proved to have existed in this lake at the 'Isola dei Cipressi' (Plate CLXVI.), towards the northern end of this little island, alongside of a rock 10 or 15 feet from the shore. The piles are seen amongst masses of stone projecting from the mud about 18 inches or 2 feet under water. On the bank itself there were scattered a number of fragments of flint both light-coloured and red, a tooth of *Bos brachyceros*, a very rude flint arrow-head, and a portion of a scraper, together with a quantity of flint chips.

A LA TÈNE,[1] NEAR MARIN (LAKE OF NEUCHÂTEL).

THIS station was known and mentioned in my first report on the lake dwellings to the Society of Antiquaries at Zürich, in 1858. The late Colonel Schwab, who kindly communicated the information, had at that time found it a rich locality, and had obtained a number of iron implements, such as swords with their sheaths, spear-heads, scythes, hatchets, knives, shears, rings, clothespins, &c. Since then, thanks to his labours and those of Professor Desor, a large number of objects have been found which are of the highest interest to the antiquary, and this station, therefore, deserves to be carefully studied.

The lake dwelling of Marin lies in a small bay with a low shore at the northern end of the Lake of Neuchâtel, not far from the place where the river Thièle or Zihl carries off the surplus waters of this lake through a moory country to the Lake of Bienne. From the observations of the late Colonel Schwab, the area with piles is from 1,000 to 1,200 feet long, and about 250 feet wide; the ground to a depth of some feet consists of a bed of peat mixed with lake mud; the thickness of this bed is not known, but it extends to the shore, and spreads over the surface of what is called the 'Gross Moos' or Great Moor of Epagnier. On this bed of peat there is a muddy layer consisting of loam and sand, and from this the rotten piles of the ancient settlement are seen to project, but only a few inches above the bottom; sometimes they stand singly, sometimes in groups of three or four, or even of seven or eight together. The place where first Colonel Schwab, and afterwards Professor Desor, made excavations, is a very low hillock, formed artificially with broken stones, called Ténevière, beginning about 60 feet from the shore, but stretching probably 150 feet into the lake; upon this the water is only two feet deep. On this 'Steinberg,' just at the place where so many weapons were found, there lay on the lake-bottom, when Colonel Schwab first directed his attention to the spot, three unworked beams of fir-wood, from 15 to 20 feet long, very nearly parallel with each other, only a few feet apart, and resting upon upright piles; a row of triangular holes were cut in the middle of these beams, evidently to receive the tenons of the upright piles which formed the walls of some erection.

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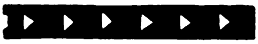
[1] The terms Tène (shallow) and Ténevière (submerged hillock) are provincialisms of the fishermen in the Lake of Neuchâtel, and Professor Desor in his late work 'Les Palafittes,' derives them from the Latin '*tenuis*.'

FIG. 29.



There was no trace of fire either on this wood-work or on the piles; and, in fact, at this station neither charcoal nor charred wood are to be found; so that this is to be ranked amongst those settlements which were not destroyed by fire. With respect to the piles, it may be noted that on the whole they are very numerous, from 8 to 12 feet long, very much decayed, and they consist almost exclusively of the softer kinds of wood.

I must also remark that the specimens from Marin, now about to be described, were all taken from the Steinberg just mentioned; in fact from a portion of the bed of the lake about 50 feet long by 30 feet broad, consequently covering an area of 1,500 square feet.

The relic-bed in the remaining part of the lake dwelling has not been examined, partly on account of the greater depth of water, and partly on account of the very soft nature of the bottom. No antiquities are found on the surface, as is the case in many other stations; they are not met with till the bottom has been trenched one or two feet deep.

Stone Implements.—Amongst these the only things to be mentioned are a number of flint flakes which lie scattered over the whole lake dwelling, and have no definite shape; also a dozen balls from six to eight tenths of an inch in diameter, ground away about a quarter on one side; some of them are of white and others of black limestone, and they evidently belong to a kind of game. The spherical form is so perfect that they must have been made by some mechanical arrangement such as is used in manufacturing playing-marbles (Plate CXXIV. fig. 20).

Bronze Objects.—Very few implements, comparatively speaking, were met with of this material. When the beam before mentioned was brought up, two or three bronze cauldrons were found, which had movable iron rings at the rim to serve for handles (Plate CXXXIII. fig. 8). Since then two hair- or clothes-pins and an earring have come to light. The other bronze implements from Marin are a small hatchet with an oval helve hole, Plate CXXXII. fig. 1, two large pieces of neatly worked plate, which had been fastened as ornaments to thin boards of wood or some other material, probably shields, Plate CXXXIII. figs. 4, 5, 6 and 9. A small wire wound into a spiral, on which is fixed a bead of blue glass, Plate CXXXII. fig. 19. A lozenge-shaped fibula, Fig. 9. Rings and other implements, the use of which is unknown to me, Figs. 17 and 20 ; Plate CXXXIII. fig. 7 ; also a pair of small pliers or hair-removers, like some of the same implements made of iron, Plate CXXXII. figs. 2 and 3. Clothes-pins and sewing-needles, Plate CXXIV. fig. 28. A ring with a handle or shank, very much worn and containing very little tin, Plate CXXXIII. figs. 10 and 11 ; this implement is 3 inches long. A massive ring 3 inches in diameter externally, and 1¾ inch internally, the section of which is circular ; a round plate, 3½ inches in diameter, of the thickness of drawing paper, and with a small hole in the middle. Plate CXXXII. fig. 27, is a hollow ring of bronze. Plate CXXXIII. fig. 25, is a bronze pin. The ring with peculiar ridges round it, Plate CXXXII. fig. 26, is not from Marin, but by some chance has been drawn in this plate: it is from Montellier.

Objects of Clay.—In general, the existence of a lake dwelling is indicated by the occurrence of fragments of pottery and other objects of similar material, in the same manner as the sites of Roman buildings are shown by bits of roofing tile ; but objects of earthenware are rare at Marin ; in fact, they consist chiefly of Roman pottery, such as a fragment of 'terra sigillata,' on which is represented a biga, and a dozen pieces of rather grey clay ; an earthenware vessel full of charcoal ; a ring of very hard burnt clay, nearly 3 inches in diameter inside, and nearly 4 inches outside ; an armlet which is rounded on the outside, and in front very neatly smoothed and polished, till it shines like some of the earthen vessels, so as to make it look exactly like the rings made of jet (Plate CXXIV. fig. 21) ; and lastly some broken pieces of Roman roofing tiles.

Objects of Glass.—Pretty rings belonging to a necklace, white, blue, and yellow in colour, Plates CXXIV. figs. 7 and 8, and CXXXIII. figs. 2 and 3; two small blue rings, Plate CXXXII. fig. 18 ; a portion of an armlet of blue glass, Plate CXXIV. fig. 6. Two rings exactly similar were found in 1842 at Horgen, near Zürich, in a grave (see vol. iii. of our Trans.). This grave, which contained a silver clasp, exactly of the form of those of Marin, a Gaulish 'Philipp's coin' of gold, &c., appears, judging from its contents, to belong to about the same age as the settlement of Marin. Rather a long bead of bluish glass, Plate CXXIV. fig. 9, and a round unperforated ball of glass, of a blue colour, with many yellow dots, which the late Colonel Schwab informed me was the head of an iron hairpin, Plate CXXIV. fig. 12.

Objects of Bone.—A fragment of a little square rod, with engraved lines and dots, which at first sight looks like a measure, but evidently was not used as such, Plate CXXXII. figs. 22 and 23. A long rectangular dice; the four longer sides are marked respectively with 3, 4, 5, and 6 dots, Plate CXXIV. fig. 4. A little ring about ¾ inch in diameter. An ornament of a cylindrical form, fig. 10. The incisor of some animal with the part between the crown and the fang cut away, so as to be used for an ornament or amulet, fig. 11.

Manufactures of Flax.—A piece of thick cloth platted out of strips of flax, exactly of the same description as was found at Robenhausen, Plate CXXII. fig. 23. (See Plate CXXXV. fig. 3.) Col. Schwab thought that this mat was not made of flax, but of bast.

Remains of Feasts.—These consist of some bones of the horse and the ox; also of hazel-nuts, burnt apples, corn, and grains of the wild mustard.

Human Remains.—A whole basketful, probably from eight individuals. Only one skull was found here, which is now in the museum of Professor Desor, and is drawn in his 'Palafittes,' page 102.

Iron Implements.—The number of specimens of this metal is surprisingly great, not only in proportion to the objects just described, but also considering the small size of the area which has been examined. It is by no means without cause that the lake dwelling of Marin has been called the settlement of the iron age. These specimens consist of weapons, of agricultural and domestic implements, and of ornaments, in which we see iron taking the place of whatever in the older lake dwellings was made either of stone, or bone, or bronze.

Several of the iron implements found by the late Col. Schwab at Marin, previous to 1858, are drawn on Plate CXXIII., and even at that time it will be seen that the collection was of much interest. These various objects, together with the large number lately found, and drawn in the other plates of specimens from this station, will now be described under their proper heads.

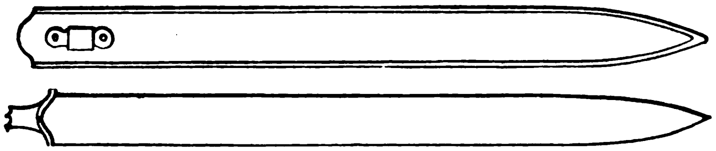
I. The swords (spathæ) are naturally of the greatest interest: they are drawn Plate CXXIII. figs. 1 to 5; Plate CXXIV. figs. 22 and 23; and Plates CXXV., CXXVI., CXXVII., and CXXVIII.

When, in the year 1858, we first published the swords which Colonel Schwab had then found, we remarked in the report made to the Antiquarian Association of Zürich, that they were of very great interest, not only on account of the excellence of their workmanship but also from the uncertainty as to their age and origin, which doubt has been carried in some antiquarian works to such a degree that they have been considered as Celto-Helvetic, as Roman and as Alemannic work.

In the first place, we may note the topographical distribution of similar kinds of swords, the distinctive characters of which are so well marked according to Professor Lindenschmit ('Alterthümer unserer heidnischen Vorzeit,' part i., plate v. with drawings of *Roman* swords). One specimen was found at Ingelheim, the iron sheath of which had the Roman letters C. S. stamped upon it; and a second was found at the foot of the Swabian Alps; a third was found with an iron lance-head and with an iron ring, smooth on one side and notched on the other, in the year 1843, in the forest of Basadingen (Thurgau), on the removal of a natural sand-hill ten feet high (see 'Wächter,' May 9, 1843), and is preserved in the Antiquarian Museum at Zürich. More than a hundred specimens of this kind of sword were dug up in the years 1849–51 at Tiefenau, near Bern, together with other iron implements, such as daggers, lance-heads, hatchets, pieces of helmets, coats of mail (even ringed armour), greaves, horse trappings, and ornaments, and all kinds of things belonging to war chariots—chiefly of iron, more rarely of bronze; besides which there were implements and ornaments both of bronze and iron (fibulæ), and also of glass, such as rings and beads, with a good deal of coarse pottery, and bones of horses. This 'find' was first described by Mr. Albert Jahn in his antiquarian and topographical description of the Canton of Bern, 1850, page 500, and afterwards described and drawn by the Baron von Bonstetten, in his 'Notice sur les Armes et Chariots de Guerre, découverts à Tiefanau, près de Bern, en 1851;' and again noticed by the first-named gentleman in the 'Jahrbücher des Vereins von Alterthumsfreunden im Rheinlande' for 1854, page 135. Mr. Jahn refers the whole of these objects, some of which are preserved in the museum at Bern, to the old Helvetian population; on the other hand, the Baron von Bonstetten assigns them to the German races who invaded Helvetia in the fourth century.

Lately, however, a treatise has appeared in the 'Revue Archéologique,' by M. Verchère de Reffye, under the direction of the late Emperor of the French, which throws great light upon these swords. It contains the result of explorations in the fortifications of Alise, the ancient Alesia, well known in the works of Cæsar, and it gives photographic views of many of the arms found buried in the ditch, evidently the relics of the struggle which took place here between the Gauls and the Romans. The reader is referred for full information to this very interesting work, but the following woodcuts of swords found there, which have been copied from it, will give some idea of the similarity if not identity of the swords found at Marin and those lately discovered at Alise:—

Fig. 30.



The swords represented in the plates before referred to are chiefly in the collection of the late Colonel Schwab, of Bienne. One of the most remarkable, which will be hereafter referred to, Plate CXXVIII., fig. 6, is in the collection of Professor Desor, of Neuchâtel.

The length varies from 2 feet 9 inches to 3 feet 6 inches. The spike for the hilt is rather broad at the bottom, on the average 5⅓ inches long, terminating in a round or flat knob. The late Colonel Schwab informed me that in probably every case the swords of Marin had wooden hilts; in fact, in some specimens he found undoubted remains of the wood itself. The blade immediately under the handle varies in breadth from 1¾ inch to rather more than 2½ inches, and narrows very gradually towards the end with tolerably straight edges, terminating in a point formed of two curves united; it is sharp on both sides, flat, and about a line and a half thick. No guard is found on any of the swords, but instead of it there is a bell-shaped strip of raised iron which forms the junction between the spike and the blade. The sheath is exactly of the same form as the blade, and consists of two pieces of iron plate, one of which is about half a line wider than the other, round which it is folded so as to form an edge or raised border. This flange or border does not extend to the lower part of the sheath, where the edges of the plates are kept together by two narrow cross-plates or strips of iron, which unite at the top of this portion of the sheath in an ornamental cross-band. This piece of iron is soldered on one side and turns round the other in a kind of clasp or cramp, also ornamented, Plate CXXV. fig. 1. In order to give greater firmness to the lower part of the sheath, the strips or plates on each side of the point swelled out slightly, and were sometimes ornamented, and the end was rather thicker. Possibly this lowest part of the sheath may have been a separate piece of iron, and the swollen appearance may have arisen from the two strips overlapping each other and being soldered together. The side next to the wearer is smooth at the lower part, but between the opening and the sword-belt loop, which was riveted on with two nails, or sometimes on the loop itself another ornamented cross-band is placed as a kind of cramp. On the opposite side of the sheath the corresponding part has an engraved or raised line ornament.

The ornaments upon the sheath are very varied, as may be seen by the drawings. Sometimes they are covered with scattered impressed rings, Plate CXXVII. fig. 10; sometimes with raised dots like shagreen, fig. 9; or with little raised rings touching each other, fig. 5; or with rows of small rings joined together as pairs by short straight lines running parallel with the sides of the sheath, Plate CXXVI. fig. 3; or with lines crossing each other like trellis-work, Plate CXXIII. fig. 3; or wavy lines closely interlaced, somewhat of the pattern of the Damascene work, Plate CXXVII. fig. 1. No trace, however, of the actual Damascene work, or the ornamentation by inlaying strips of gold and silver, which is found in Roman and more especially in Frankish ornaments, has hitherto been noticed either at Marin or any similar locality.

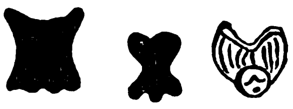
By far the most remarkable ornament on a sheath is that drawn Plate CXXVIII. fig. 6. It is in the collection of Professor Desor. On a dotted ground three fantastic animals like roes are represented running, and all their extremities, horns, mouth, tail, and feet, terminate in sprigs of plants or flourishes. Similar representations have been published amongst the figures on northern antiquities, especially in Irish and Anglo-Saxon miniatures. This design is particularly interesting, as the animals most strikingly resemble those on Gaulish coins, Plate CXXXIII. figs. 18 and 20 to 24.

With respect to the mode by which the ornamentation was effected, that on Plate CXXVII. fig. 1, and on fig. 5, according to the unanimous opinion of many 'experts,' has been done by etching and with the hand alone; while the crossing lines of Plate CXXIII. fig. 3, have undoubtedly been impressed. The mode by which the shagreen ornament was made is uncertain, and it is also very difficult to say whether the line ornaments at the very top of the sheath were the work of the chisel or of an acid like vinegar or lemon juice, &c. It is, however, evident, that the ornamentation on the sheath, Plate CXXVII. fig. 4, was made by the use of a fine chisel, and on that of Plate CXXVI. fig. 3, by the strokes of a punch.

The general appearance of these swords would lead us to the conclusion that they were not the work of any isolated military smith, but may be considered as the production of larger workshops and manufactories, where there was a division of labour and every practical appliance; and this view is fully confirmed by the 'maker's marks' found on several of the blades.

Thirteen marks of this kind are already known, of which the two left-hand figures and the upper right one of Plate CXXVIII. fig. 11, and also the upper one to the left of fig. 12, are somewhat similar, and probably indicate the same company; fig. 13 is rather similar. With the exception of the rude figure of a boar, as shown fig. 14, in three lately found, shown in the annexed woodcut, and in the trefoil, all the marks bear some resemblance to the form of the half-moon, which, as well as the boar, appears on many Gallic coins. If the remaining marks are found on Gallic coins, the supposition would probably be correct that different districts were indicated by these marks. No trace of a letter has yet been discovered. Amongst the swords of this description the specimen published by Professor Lindenschmit (Alterth. u. heidn. Vorzeit, Heft i. taf. 5), on which the letters C.S.I. appear, in this respect remains unique.[1]

Fig. 31.



About fifty swords have been found at Marin up to the present time, some with and some without sheaths. The latter are all made of iron, with one single exception, which consists of thin bronze plate. They are, on the whole, masterpieces of the smith's art, and in making them the hammer was chiefly used —not the file—and the polish of the smooth, shining portions was obtained by the use of scraping and grinding tools. Not one of these swords, either in length, breadth, or weight, is exactly like any other; and the ornamentation is remarkably different in every specimen. Most of them are in good preservation, but still some of them are bent and full of notches at the edge, Plate CXXVI. fig. 1.[1]

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[1] We hope that Professor Lindenschmit will not take it ill if we do not consider these letters as Roman. They stand obliquely on the sheath, one above the other.

We are indebted to M. de Reffye, in the work already referred to, for the following particulars as to the mode of manufacture and the materials employed for making the swords found at Alise, and we may with safety conclude that the analogous arms found in Switzerland were made in the same manner. 'We may remark,' he says, 'that the cutting edges of these swords are not of the same iron as the body of the blade. The workman, after having forged this part out of very tough iron (très-nerveux, very fibrous iron), drawn out lengthwise, welded on each side little strips of soft iron to form the cutting edges; this iron was afterwards beaten to an edge by the hammer. The soldier could thus after the fight repair with the hammer the damage done to his sword, just as a reaper sharpens his scythe when it is notched. The sheaths of these swords are of iron; they appear all to have been made on the same plan.'

Many of the swords found at Marin had pieces of charcoal attached to them, which seems to show that they had not fallen into the lake by chance, when a vessel was lost, but had sunk into the water and mud when the lake dwellings were burnt.

There has always been very considerable difficulty in determining the age and origin of swords. The authorities used for this purpose have been the representations on Roman sculptures; the description of these weapons in Polybius, Livy, Vegetius, and others; the nature and peculiarities of the antiquities found with them; and, lastly, such histories of a country as give any account of the early population, and the native arms and equipments. But, with all these helps, it has always been a very difficult matter to decide with certainty whether a sword has belonged to a Roman or non-Roman warrior, or in fact to what age it belonged. Very different views have been expressed as to the swords preserved in various collections, just as the investigators' attention is drawn to the shortness, or the length of the blade, and to the bluntness or sharpness of its point.[1]

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[1] In one or two of the swords in the Schwab collection it appears as if the middle portion of the blade was made of iron and the two sides had been of steel, welded on to the centre; at least the middle part is pitted with rust while the sides are comparatively smooth.

With reference to the present locality, the greatest light thrown upon them has been by the discovery of the swords found in the ditches of Alise before referred to, which evidently were of Gaulish origin, and agree exactly in general form with those of Marin. The ornamentations of the Alesia swords have for the most part disappeared; those on the weapons from Marin are in very good preservation, and ought to be the safest grounds for deciding their origin. We must, however, remind the reader that these ornamentations do not show the least relation to the Celtic implements which have come to light and quite as little so to those of Roman origin. We cannot, however, help mentioning the peculiar ornamentation so very different from the Celtic element, which is to be seen on some bronze rings drawn in the Baron von Bonstetten's 'Recueil,' plate vii. fig. 4, and in vol. ii. of the 'Bulletin de la Société pour la Conservation des Monuments Historiques d'Alsace,' plate ii. fig. 5.

II. Spear-heads (lanceæ) Plate CXXIII. figs. 11 to 16; Plate CXXIV. figs. 1 and 2; Plate CXXIX. figs. 1 to 5; Plate CXXX. figs. 1 to 4 and 7 to 9; Plate CXXXI. figs. 1 to 7; and Plate LXXXVIII. fig. 1. If the swords appear to have been made after a normal form, thus differing essentially from other weapons of that kind, the lance- and javelin-heads exhibit a great variety of shape, which leads to the conviction that the makers did not follow any pattern, but worked simply according to their own fancy. As there is no actual difference between weapons used to thrust and those made to be thrown, we can only classify these weapons by the length of the socket and the breadth of the blade. In each of these divisions, however, there are many varieties in the form of the blade. Sometimes it diminishes like a willow leaf, or it terminates in a sharp needle-point; sometimes the form is like that of a flame, or approaches that of a laurel leaf. The length of the longest of these weapons is 18½ inches, that of the shortest 5½ inches. The breadth of the widest is 3½ inches, that of the narrowest about eight-tenths of an inch. Some have been made very weak, and others very strong. Again some have a very considerable ridge in the middle, while others have none, and of those which have a ridge it is sometimes angular and sometimes half-round. The weight also differs very considerably. In general, they are distinguished from Roman and mediæval weapons of this kind by being lighter. On the sockets of some of them there is a rivet-hole which is wanting in others. No ornaments are to be seen on any of the spear- or the javelin-heads found at Marin, except the engraved or raised lines on the borders of the socket.

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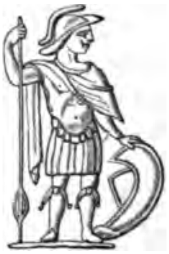
[1] Respecting the form of Roman swords see the 'Rheinländische Jahrbücher,' pt. xxv. p. 110.

These implements are quite as remarkable as the swords for the ability displayed in their manufacture. The smith evidently understood how to bring his work to such perfection as to indicate a high grade of his art. The angular longitudinal ridge (nervure), which from the investigation of M. de Reffye is hollow, runs from its commencement at the socket, gradually diminishing to the point: and the two sides of the blade, the thickness of which diminishes at the edge to about the fiftieth part of an inch, are so skilfully hammered out and made smooth, and polished by scraping tools and grinding stones, as to leave nothing further to be desired as far as the workmanship is concerned. It is not impossible, especially in the specimens with hollow ridges, that the two plates were welded together into a blade in the manner commonly used in the middle ages for making halberds. The socket, as shown by the seam, was made by bending round the plate of the blade and welding it. The use of such workmen's arrangements as the 'set-hammer' or intermediate hammer with a 'swage' or groove, and what is called the 'under-tool' or small anvil with a corresponding groove or 'swage,' may be considered as certain. The action of a file has not been noticed on any of these weapons. M. de Reffye has shown that the material is steel.

Amongst the large number of these weapons those drawn Plate CXXIV. fig. 1, and Plate CXXIX, figs. 3 and 4, are unquestionably the most remarkable,[1] as from their peculiar form they differ materially from similar weapons either of barbaric or classic antiquity. The blades, in fact, have portions cut out either on the outside or in the middle near the ridge, in the shape of the segment of a circle. At first sight, one might suppose that these had arisen from defective places caused by rust, or by the bending of thin plate which was put to such a trial and which the smith endeavoured

FIG. 32.



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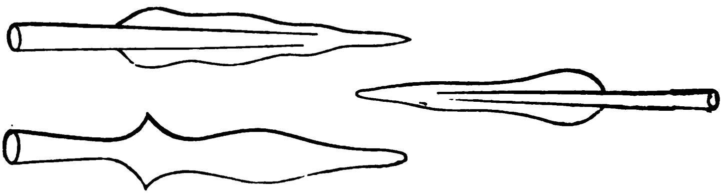
[1] The annexed woodcut (fig. 33, p. 417) of three of the lances found at Alesia, copied from the work of M. de Reffye, will show how very similar they are in form to some of those found at Marin.—[TR.]

to remedy by giving the instrument a regular form, but this supposition could have no foundation with respect to the parts cut out in the middle of the blade.[1] Similar excised portions, in the form of a circle and semicircle, are known even in the older bronze weapons of this nature (see the 'Horæ Ferales,' plate vi. figs. 16 and 23), and are considered by Mr. Franks as the means of lightening the implement and saving the metal. There can be no doubt that the excised portions on the edge of the blade would make the weapon more dangerous, and increase the size of the wound, just as greater effect was ascribed to the flamboyant sword of the Middle Ages than to the straight sword. The specimen drawn Plate CXXIV. fig. 1, plainly shows that some advantage was expected from such refinements in the form of the spear-head.[1]

FIG. 33.



The specimen drawn Plate CXXIV. fig. 2, is no less remarkable. It is in the late Colonel Schwab's collection, and is 9 inches long from end to end, of which the socket is 2 inches and the blade about 7. It is more than 3 inches broad and has an angular ridge which projects considerably. What distinguishes this specimen from others is the fact that the edges of the blade are indented at regular intervals, so that the side view, as shown in the plate, instead of being straight is sinuous. It will readily be seen that this arrangement was intended to tear the flesh and to increase the size of the wound both when it entered and when it was withdrawn.

This weapon is of peculiar interest, as in all probability it brings before us the kind of spear described by Diodorus in his account of the military equipment of the Gauls, v. 30. The following are his words :—'They use for weapons lances, which they call *λαγκίας*, which have appendages (points or heads) of iron an ell in length or still more, but in breadth somewhat narrower than two palms (hand-breadths). For the *ξίφη* (the short Greek or Roman legionary swords) are not smaller than the "saunia" used by other nations, but the "saunia" (of the Gauls) have greater heads than the *ξίφη*. Of these some are forged straight, but the others have throughout a wavy indentation (*ἑλικοειδὴς ἀνάκλασις*) in order that when it strikes it may not only cut but also lacerate the flesh, and tear open the wound when it is withdrawn.'

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[1] I am indebted to my friend, the Rev. C. W. King, for the woodcut, fig. 32, p. 416. representing, on an enlarged scale, the reverse of a coin of Constantine, minted at Trèves, and now in my collection. Mr. King, in his unpublished treatise, from which he has allowed me to make extracts, says: 'It shows the Gallic Mars equipped with the peculiar national lance with its enormously dilated blade and lunar-shaped barbs, and a shield perfectly novel in construction. On several coins also of the same date, issued from Gallic mints, the cavalier on the reverse wields a lance, the blade of which is two feet in length—judging from the proportions of the rest of the design.'—[TR.]

The expression *ἑλικοειδὴς* is generally translated in German by the word spiral, and it is supposed that the head of the spear was twisted round on itself in a spiral form; but according to this view we should have a very useless instrument, in fact, it is one which never existed. In the French translation of Miot the words run thus: De ces armes les unes sont forgées droites, d'autres en zigzag avec l'extrémité recourbée en arrière.' In the original, however, there is nothing about the 'extrémité,' but, on the contrary, a curvature or indentation throughout. Moreover a lance-head twisted in a zigzag and with the point bent back would be a still stranger form than what has just been alluded to. The expression *ἑλικοειδὴς ἀνάκλασις*, as it appears, is to be understood as 'with wavy indentations,' and in the passage referred to it means that the edge of the spear blade which usually is in a straight line, is bent alternately up and down so as to form a sinuous line.[1]

With respect to the use of these broad spear-heads, it may be remarked in general that, on account of the shortness of the socket, the small thickness of the shaft, and the weakness of the blade, they must have formed very feeble weapons, and necessarily have bent when they came against a shield or a breast-plate on some powerful antagonist. They appear chiefly fitted for wounding unprotected parts of the body, not for thrusting through; in fact, specimens are found which must have been used more for parade than actual fighting.

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[1] Diod. v. 30. *Προβάλλονται δὲ λόγχας, ἃς ἐκεῖνοι λαγκίας καλοῦσι, πηχυαῖα τῷ μήκει τοῦ σιδήρου, καὶ ἔτι μείζω τὰ ἐπιθήματα ἐχούσας· πλάτει δὲ βραχὺ λειπόντα διπαλαίστων. Τὰ μὲν γὰρ ξίφη τῶν παρ' ἑτέροις σαυνίων εἰσὶν οὐκ ἐλάττω, τὰ δὲ σαυνία τὰς ἀκμὰς ἔχει τῶν ξιφῶν μείζω. Τούτων δὲ τὰ μὲν ἐπ' εὐθείας κεχάλκευται, τὰ δὲ ἑλικοειδῆ δι' ὅλων ἀνάκλασιν ἔχει, πρὸς τὸ καὶ κατὰ τὴν πληγὴν μὴ μόνον τέμνειν ἀλλὰ καὶ θραύειν τὰς σαρκὰς, καὶ κατὰ τὴν ἀνακομιδὴν τοῦ δόρατος σπαράττειν τὸ τραῦμα.*—*Reiske's Version.*

The passage, however, is corrupted, as is rightly remarked by M. de Rougemont in Professor Desor's 'Habitations lacustres;' for, in the middle of the description of the lances, there is interpolated a comparison of the 'xiphos' with the 'saunion,' of which nothing else is said in this book. Whatever way these words may be turned, it is impossible to bring the sense into connection with the context, and the only way is to consider the sentence from Τὰ *μὲν γὰρ ξίφη* to *ξιφῶν μείζω* as an interpolation, and to refer *τούτων δὲ* to the word *ἐπιθήματα*.

[The author, with his usual candour, will, I trust, forgive me for mentioning that his views as to the interpolation of this passage are not agreed to by more than one of the leading classical scholars in England. This, however, is not the place to enter into a discussion of this nature.—Tr.]

III. Ferrules or points for the feet of the lances.—About half-a-dozen specimens of the ferrules or points for the lower part of the shaft of the lances (*στύρακες*) have been found, which were as carefully made as the other part of the weapons just described; they are conical points, having eight or ten sides, and vary in length from 4¾ to 7 inches. Two specimens of the simplest form are drawn Plate CXXXII. figs. 15 and 16. In order to prevent the splitting of the shaft where the spike goes into it there is a ring or cramp which fits close to the base of the point. Some of these ferrules and rings are a little ornamented.

No arrow-heads were found either at Marin or at Tiefenau, a locality which will shortly be referred to, from which it may be inferred that the people to whom these weapons belonged did not use the bow.[1]

IV. Shield plates (straps or handles).—The shields found in England corresponding in the character of their ornamentation with the sword sheaths met with both there and here (at Marin and Tiefenau), had rather a long rectangular form, sometimes rounded at the corners. This form of shield is also, in fact, indicated by an implement made of iron plate found with the above-mentioned swords, not only at Marin but also in the graves.

These shield-mountings are drawn Plates CXXXI. fig. 8, and CXXXII. figs. 13 and 14. They consist of iron plates from 8¼ to 14 inches long, from 4 to 5 inches wide, and very thin, the middle part of which is hammered out into an arched form, and the edges are bent down on all the four sides. The two wings are broader at the end, and have the edges sometimes cut out ornamentally. They have been fastened to the shield by flat-headed nails or studs with the heads about an inch and a third in diameter. The shield, judging from the space between the head of the nail and where it was bent round, must have been from ½ an inch to $\frac{6}{10}$ths of an inch in thickness; some fibres rusted on to the plate show that it was made of wood.

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[1] Diodorus does not mention the bow as one of the weapons of the Gauls; on the contrary, Strabo says that it was used by some of the Belgæ.

Plate CXXXII. figs. 10, 11, and 12. This implement consists of two four-cornered plates of iron, joined together by a curved iron rod riveted to the plates, and which seems intended for a handle. We have some doubt whether it was a shield holder.

Plate CXXXIII. figs. 12, 13, 14, and 15. We cannot determine whether these two implements were intended for warlike or household purposes. They consist of iron rods rather more than ½ an inch thick, bent round into the segment of a circle, and having a spike at one end and a kind of cap or hood at the other. They seem to have been fastened by this cap into some other object, and the spike at the other end has been let into a hollow, or has had something fixed to it. One of these implements, Figs. 12 and 15, is ornamented and uncommonly neatly worked. The other, Fig. 13, is more simple: the section is quadrangular and the outside of the curve is ornamented with longitudinal furrows. Probably these specimens are of a similar description to the bronze implements with a ring at one end, found at Tiefenau, and drawn by the Baron von Bonstetten in his 'Supplément au Recueil d'Antiquités Suisses.'

Plate CXXXII. figs. 4 and 5 are appendages to some object smaller than those last described: they are all of one piece. Both are a little bent round, but a third specimen, exactly like the second, is quite flat. Fig. 6 is an implement, possibly of the same kind, shaped like a spatula.[1]

Amongst the implements evidently belonging to domestic economy may be mentioned an iron ladle, Plate CXXXIII. Fig 1; the staple, Plate CXXXII. fig. 7; the ring and staple, Fig. 8; some wire, Fig. 21; as are probably also some rings, Figs. 24, 28, and 29; an iron hook, Fig. 25, and a ringed staple, Plate CXXII. fig. 6.

Two three-pronged iron forks were found here: one of them is drawn Plate CXXIII. fig. 18.

Plate CXXIII. figs. 22, 23, and 24 are hatchets. Fig. 22 has the sides bent up so as to form flanges for the shaft like those of some bronze celts. Fig. 23 has these side flanges bent so far round as to meet and form a socket; thus these two specimens show very clearly the transition from shaft flanges to sockets. Fig. 24 does not differ from the Roman form.

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[1] Compare the shield-handles drawn Plate 8, figs. 5 to 10, in the very interesting work by Engelhardt, on the Danish antiquities of the early iron age, which appeared while the first edition of this work was going through the press. The Danish handles are of wood, bronze, and silver, ornamented with gold.—[Tr.]

Plate CXXIV. fig. 18 is a kind of hatchet or gouge; it is more than 3 inches long, and the cutting edge is about 1½ inch broad; it has a socket though the sides do not quite meet, so that it is somewhat like the bronze celts; the edge is not straight, but, like a gouge, is intentionally curved and in an opposite direction to the sides of the sockets. It had been fastened to a handle with a nail. Plate CXXIII. fig. 21 is a tool like a spatula or gouge about 1 foot in length. Fig. 17 may have been a small dagger. Figs. 19 and 20 are hedging and pruning bills. Fig. 26 is a pair of shears. Fig. 27 is a currycomb; the raised part at the top is prolonged backwards into a handle. Fig. 8 is a steel for striking fire, like one found in a grave at Holderbank in the Canton of Aargau. Figs. 9 and 10 are knives. Plate CXXIV. fig. 3 is also a knife. Several other cutting instruments were found ground like knives: in some specimens, the end was bent round into a handle or terminated, like this specimen, in a ring; they evidently were carried or suspended from the person. In one of the holes in the handle, there was a small wire. They resemble the bronze knives from Nidau Steinberg, drawn Plate XXXV. figs. 20, 23, and 24; and the implements found in Etruscan tombs and considered as razors (see Gozzadini, 'Sepolcri Etruschi').

Plate CXXIV. fig. 27 is a scraping iron: a kind of knife 7 inches long and in the middle $\frac{8}{10}$ths of an inch broad, somewhat in the form of a segment of a circle; it is throughout rather more than $\frac{1}{10}$th of an inch thick, but is ground slopingly on the convex side: apparently it has been used less for cutting than for scraping, and probably had a handle at each end.[1] Fig. 14 is a hexagonal tool called by workmen a 'rimer' or a 'taper drill,' for widening holes. Fig. 16 (and 19 side view) is a hook made of a strip of iron pointed at one end. Fig. 13 is a Roman key.

Several pins were found at Marin with round or triangular heads, rather flat, and with perforations of a corresponding form. A number of rings were met with, rather flat, from $\frac{1}{12}$th to $\frac{1}{4}$th of an inch thick, the diameter of which internally is from $\frac{6}{10}$ths to $\frac{8}{10}$ths of an inch, and externally from 1½ to 2 inches. On one side they are rather convex, on the other slightly concave, and thinner in the middle than at the edge. They appear to have been used as some kind of support.[1]

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[1] Probably this implement was used like our modern 'hoopshavers.'—[Tr.]

Plate CXXIV. fig. 5 is a horse's snaffle-bit. It consists of two neatly-made portions joined together, so as to be movable; at the two ends there are large rings, also movable. The width of the bit between the large rings is 3½ inches. The rings of this bit, in the places where they touch, have, by long use, been worn through to half the original thickness. Two specimens were found of this kind.

Plate CXXIV. fig. 15 is a linchpin. This implement is in the form of a saddler's knife, with a round rod attached to it; in the flat portion there is a rectangular hole. It may probably have been used for a cart-wheel.

Plate CXXIII. fig. 25 is an anchor made of stone and iron. The centre portion is an eight-sided prism of stone, about 30 lbs. in weight, into the lower part of which iron arms are fastened, bent, and of the shape of willow-leaves. Originally it had four of these arms or hooks. The upper hole was used for fastening the cable to it.

Ornaments.—Amongst these the clothes-clasps, or fibulæ, are the most remarkable; they have been found in great numbers. The late Colonel Schwab's collection contains more than 100 specimens. They vary very much in size, without exhibiting any striking variety of form. They all consist of a single piece of wire, which is twisted nearly into the shape of a figure 8. At the upper end of the fibula, or rather at the lower, for, when fastened to the clothes, the pin pointed upwards (see vol. xi. of our Transactions, part iv. plates i. and ii.), this wire, in order to give elasticity to the fibula, is wound round into a spiral, and at the other end of the clasp the wire was beaten flat and bent half round, so as to form a kind of socket to receive one end of the wire which formed the pin or tongue. The other end of the wire, in order to give greater firmness to the whole, is, in the simplest form, attached to the main or middle portion by a kind of hook which runs round it, but in the specimens of a better description the two are fastened together by a ring at the point of contact. This portion is sometimes ornamented with incisions at the side, and sometimes with projections like beads or rings. Some of the prettiest specimens are drawn Plate CXXIV, figs. 24 and 25; also fig. 26, in which both the knobs on the main stem are of bronze. Other specimens are drawn Plate CXXIII. fig. 28, and Plate CXXI. figs. 1 to 9 and 13.

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[1] May they not have been what are now called 'washers' by coachmakers and others?—[Tr.]

This kind of clasp is found very widely diffused, and was long in use. The same form was found in the bronze age, in the graves at Hallstadt, and in the Gallic tomb at Horgen, &c.

Plate CXXI. figs. 10, 11, and 12, and Plate CXXII. figs. 1 to 5 are buckles. They consist chiefly of a ring or a quadrangular frame, by which they were fastened to the straps, and an arm-like appendage, on which is a knob, by which to lay hold of something at the other end of the strap. These implements had, however, a variety of forms, as may be seen by the drawings, Figs. 7 to 11, 14 and 22. The rings, Figs. 7 to 10, of which a large number have been found, are flat on one side and ornamented on the other.

Plate CXXIV. fig. 17, are small pliers for the lamp, or for pulling out hair. More than a dozen of these implements have been found; the largest is 4¾ inches and the shortest 2 inches long. They are made out of strips of plate, narrower at the top where they bend round, than at the ends, which, in the largest specimens, are ¾ of an inch wide. In the specimen drawn, the arm or upper part diminishes to a thin round wire.

Plate CXXII. figs. 12, 13, 15 to 21, are buttons or knobbed nails. The heads, some of which are round and some flat, are ornamented in various ways. Fig. 21 has a part of the wood still remaining in which it was fixed.

Plate CXXIII. figs. 6 and 7, and Plate CXXX. figs. 5 and 6, are sickles. Fig. 6 of the first Plate approaches in shape those of the bronze age. Fig. 7 of the same Plate has the edge finely serrated.

Coins.—Some of those found here are Roman and some Gallic. Those of the first description are an As, a Tiberius, and a Claudius. Those of the latter are, *first*, a quarter-stater of gold, which has been found very commonly in Switzerland, and may be considered as having been the current money of the Helvetii. It is a bad imitation of the Macedonian coins of Philipp, and has on the obverse the head of Apollo with the fillet of laurel, and on the reverse a biga, with the emblem of a bird under the vehicle, and some letters which may be read ΦΙΛΙΠΠΟΥ. Very probably the gold was collected in the Aar and its tributaries, and the money coined in Aventicum. Plate CXXXIII. figs. 16 and 17. (See vol. iii. page 12, of our Transactions; also the 'North Etruscan Alphabet' of Mommsen, vol. vii. page 244; and the 'Gallic Coins' of Dr. Meyer, vol. xv. page 19, of our Transactions.) *Secondly*, some Massilian silver coins, Fig. 19. *Thirdly*, several coins cast from a mixture of copper, lead, and tin (Potin), which are commonly found in the districts of the Helvetii, the Sequani, and the Ædui. On one side there is a head, and on the other the figure of a fanciful animal with a mane, short horns, and long tail. It is difficult to say whether a horse is intended to be represented. The workmanship is very rude. Plate CXXXIII. figs. 18, and 20 to 24. (See Lambert, Essay, pp. 7 and 41; De Saulcy, Revue Num. 1860, page 168; and Meyer's 'Gallic Coins,' page 22.)

ORIGIN AND AGE OF THE IRON IMPLEMENTS OF MARIN.

When these swords and other weapons were first discovered and published, I called attention to the fact that at that time there were no safe data on which to rely, and that their ornamentation was neither of a Roman nor of an Alemannic character, and also that it differed quite as much from those of the Celtic implements hitherto met with, and that on all these accounts our judgment respecting them must be reserved till the matter had been further investigated.[1]

Since then, however, many important discoveries and investigations have brought this question nearer to its solution, and I will now bring forward the facts which bear upon this point, and mention the localities where similar swords have been found, and also state the conclusions that may be drawn from their form and ornamentation.

The discovery of a number of weapons in excavating the ditches of the fortress of Alesia (now Alise-Sainte-Reine) was of great importance in determining the origin of these iron implements. The swords found here, which without any doubt were lost in the conflict when this place was besieged (Cæsar, *B. G.*, vii. c. 69–90), have been carefully described and drawn in the work before referred to, by M. Verchère de Reffye, in the 'Revue Archéologique' for November 1864.

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[1] Mr. Jules Quicherat, in his treatise published in the 'Revue Archéologique' (1865, p. 81), 'Examen des Armes d'Alise trouvées à Alise-Saint-Reine' affirms from a passage taken out of M. Troyon's 'Habitations lacustres,' p. 197, that the author of this volume had expressed an opinion that these swords were not of Celtic origin. He evidently had taken no notice of M. Troyon's remark, 'M. Keller, tout en suspendant son jugement sur l'origine de ces épées.'

Some very well-executed casts of these swords, for which our Society has to thank the munificence of H.I.M. the late Emperor of the French, enabled us to institute a careful comparison of them with our own. These weapons are, for the most part, so exactly like those of Marin that everything which M. de Reffye reports of them will also apply to the swords of Marin.

The place where they were found, as well as the marked difference between the character of these swords and lance-heads from those of the Romans, decide the question to which of the two sets of combatants these swords are to be ascribed. And thus are we able also to determine most satisfactorily the age when they were in use.

The information also is very instructive which is given by Mr. Franks on a series of weapons and other implements of bronze and iron, in the 'Horæ Ferales, or Studies in the Archæology of the Northern Nations,' by J. M. Kemble, page 172. These implements, given under the title of antiquities of the later Celtic period, consist of shields, helmets, coats of mail, swords, spears, daggers, horse-trappings, metal-work for chariots, ornaments, and a number of objects of different uses. The swords have in general the same form and ornamentation as our own, and on most of them there is a similar richness of decoration.

Mr. Franks very justly lays claim to these swords as products of art by the Celtic nations, and especially by the inhabitants of the British Isles and of Northern Gaul; and he rejects the view that they had anything to do with the Etruscan, Roman, or Germanic races. The proofs of this may be examined in 'Horæ Ferales,' page 184.

If we carefully examine the designs upon the sword-sheaths of Marin we shall notice a peculiar ornamentation, the elements of which, small in number, consist of the waved line, the circle, and the triangle. But these designs have several appliances added to them. Thus at the points of the triangle there are sometimes small flourishes not unlike the tendrils of the vine. Again, the circles are always found in pairs, and the two are joined together with a kind of strap, and recall the idea of the 'spectacle ornament' of the old Scottish monuments. (See Stuart's 'Sculptured Stones of Scotland.') Above this, in what may be called the tympanum, there are ornaments shaped like birds. Sometimes the whole design looks like a display of calligraphy. Representations of vegetable and animal life are wanting, with the exception of fanciful animals, whose extremities terminate in flourishes. The character of this ornamentation is connected with that of the late Celtic period brought before us by Mr. Franks, and is entirely different from classic and oriental taste.

The antiquities found at Tiefenau also are of great importance in ascertaining the origin of the weapons of Marin; they have been described and drawn by the Baron von Bonstetten in two excellent treatises, one of them entitled 'Notice sur les Armes et Chariots de Guerre découverts á Tiefenau, près de Bern, en 1851.' Lausanne, 1852; and the second, 'Supplément au Recueil d'Antiquités Suisses.' Lausanne, 1860. Further notices respecting these antiquities will be found also in Jahn's 'Canton of Bern,' pp. 191 and 500.

The specimens found at Tiefenau may be classed according to the material into implements of iron, such as weapons, horse and chariot gear, ornaments, &c.; into those of bronze; those of clay, such as Gallic and Roman pottery; those of glass, such as rings or beads of variegated colours; and also Gallic coins of gold, silver, and bronze.

All these objects bear most unequivocally the character of the implements found at Marin, as may be seen by comparing the plates in the works just mentioned, with those in this volume, and in some respects they agree exactly. Thus, the swords, spear-heads, bits, linchpin, ornamented rings, fibulæ, knobs, pliers, and coins, have perfectly analogous specimens amongst those of Marin. But amongst the things found at Tiefenau there are also some rather different specimens, which complete the warlike equipment, viz., fragments of ring-armour (lorica) and a dagger, portions of a war chariot, such as the tires of wheels, the nave, the linchpin, &c.

Further discoveries of weapons and implements of the kind just described have been made in many parts of northern and eastern France, in that part of Germany lying on the right bank of the Rhine, in Switzerland, and also, as above mentioned, in England. One single sword of this nature has been found in Hungary.[1]

The coins found mixed with these antiquities may be of some assistance in investigating their age. According to the determination of M. de Saulcy they consist of the following specimens:—15 plated silver drachmæ; 1 obolus, and 1 bronze coin of Massilia; 2 'Potin' coins of the Sequani; 1 silver coin of the Leuci; 1 Tulingic silver coin in imitation of the 'Philippus money'; and 1 bronze coin of the Parisii.

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[1] See the atlas to the 'Archæologiai Közlemények,' pt. ii. plate v. The antiquities found in the tomb at Sinsheim belong to the category of the things found so abundantly in the tumuli of South Germany, Alsace, and Switzerland, and are quite different in character from the objects now under consideration.

PLACE OF MANUFACTURE OF THE MARIN ANTIQUITIES.

The following facts result from the investigation of the arms and implements of Marin, and their comparison with the specimens found in England, Alesia, and Bern:—

The form of the swords and the lance-points, the ornamentation of the sword-sheaths, the marks on the sword blades, the numerous Gallic coins found with them, and the widespread district where they occur, show that all the Marin antiquities come from some of the workshops of Gaul, perhaps situated amongst the Belgæ.

The agreement between the warlike equipment of the Gauls, as mentioned in Diodorus, v. 30, with the antiquities found in Gaul and Britain, and also with many of those just described, is very striking. Amongst the antiquities from Britain we find the long shields of the Gauls, with the figures of animals fastened on them; the lance-heads an ell long and two hand-breadths broad, and the spear-heads with wavy indentations.

In determining the age of the questionable specimens, the coins found with them are of the first importance. The Massilian gold and silver coins, and more especially the imitation of the 'Philippus money' in gold, appeared very early as the circulating medium of the chief emporium of Gaul, continued in use many centuries, and spread over a wide district; but they afford us just as little ground for determining the age as the 'Potin' coins of the different eastern provinces, which must have been in circulation at the time of Cæsar and Augustus. The Roman coins, the fragments of 'terra sigillata,' and the roofing tiles, give more definite information. With respect to the latter, we may assume with all certainty that there were here no roofing tiles before the founding of the knights' colony at Nyon, under Cæsar or Augustus, or before the establishment of the camp at Vindonissa; and in like manner there would have been just as little of the better kinds of Roman pottery for the table before the spread of Roman civilisation in the first century. The coin of Claudius found here, the latest of those, may probably indicate that the occupation of the station of Marin was then drawing to a close.

We ought, however, to remark that we have not the slightest certainty that the few Roman objects found here had any connection with the Helvetian implements of iron, or with the lake dwelling. A great number of fragments of tiles occur in the soil of the bank where the piles stand; and not far off on the moor there are the remains of a Roman settlement, with heaps of fragments of tiles; in fact the whole district is full of the relics of Roman civilisation. And as at the mouth of the Broye, in the lake of Neuchâtel, and at that of the Thièle and the Scheuss, in the lake of Bienne, and also on many shores both with and without pile dwellings, Roman implements, from causes unknown to us, have fallen into the water, so a similar chance may have occurred as to the Roman antiquities found at Marin, and we have no actual right to attribute them to the ancient inhabitants of the lake dwellings.

But if we regard the weapons and other iron implements as belonging to the lake dwelling, and thus bring down the existence of this station to historic times, and consider the Helvetii, well known in Roman history, as, at one time, its inhabitants, the question arises, why, when the Gallic people had made such advances in civilisation and in regular political relations, a kind of settlement so little consonant with the requirements and development of a different mode of life should have been continued to such a late period. It may further be asked whether the lake dwelling was not affected by the events of the emigration of the Helvetian race and the destruction of their abodes.

We have already remarked that as yet excavations have only been made at a few points of small extent in the widely spread settlement of Marin, and the nature of this lake dwelling as a whole is as yet but little known. And not until this locality has undergone a searching examination, and the materials for judging as to the character of this problematical settlement are laid before us in greater abundance, shall we be better able satisfactorily to answer these and many other questions respecting it.

In looking over the specimens from Marin what strikes us most is the fact that the weapons and other implements differ so essentially, both in material and form, from the products of the older settlements: not only has iron taken the place of bronze, but the form and ornamentation are so different that one is tempted at first sight to attribute their origin to another nationality and another district. But when we carefully consider this phenomenon it appears less striking. For if we compare the relics of a pure bronze station, such as Morges, with those of a pure stone station, such as Wangen or Moosseedorf—that is, of simple bronze implements with those of stone, wood, and bone—the difference between them, in whatever is necessary for sustaining life, is found to be much greater. It is certain that there are passages or transitions from the stone to the bronze period. On the one hand, we find a number of stations in which stone and bronze objects are mixed together in different proportions, and which reveal to us the gradual diffusion of metal tools. On the other hand, we can follow up the development of the art of bronze casting, and see how at first the implements of this material took the form of those of the stone age. The connection of the productions of bronze with those of the iron stations is less striking to the eye. There are indeed some forms of implements which remind us of those of the previous age. But, on the whole, when the Marin objects were made, iron had taken full possession of the field, and all the implements, including ornaments, which could be made out of iron, a metal both firmer and more pliable, were manufactured out of this material. But the form of these specimens had in some measure undergone a change, for the working of iron is a totally different matter from that of bronze; and the hammer of the smith and the moulds of the founder cannot produce the same forms. The remains of the settlements of the pure stone, bronze, and iron ages indicate therefore epochs of civilisation amongst the inhabitants, separated by long intervals, while the end for which the lake dwellings were erected, viz. the security of person and property, and their construction remained the same.

Professor Desor, in the preface to his work above referred to, expresses the opinion that the Helvetii who came in as conquerors out of Germany, having become acquainted with the use of iron in their old abodes, introduced this metal and the coining of money into the country between the Alps and the Rhine.

We cannot refrain from once more repeating what we have stated in the previous parts of this volume. There can probably be no doubt that from the earliest ages the above-mentioned country, and also the land beyond the Jura, was inhabited by races of Celtic origin. But how can it be imagined that the inhabitants of our valleys, who had intercourse with the civilised nations on the shores of the Mediterranean by the paths of the Alps and the valley of the Rhine, had remained so far less civilised than the races dwelling immediately opposite to them between the Rhine, the Maine, and the Black Forest as to be indebted to them for the knowledge of iron, &c.? But the monuments of the country, as well as the reports of historians,[1] teach us that the Helvetii from the earliest ages were in possession of this district, and besides this a careful examination of the passage in Tacitus (*Germania*, 28; compare Cæsar, *B. G.*, vi. 24) shows that the question is not of a hostile attack on the Alpine district by the Helvetii living between the Rhine and the Maine (the district called in later times *Agri Decumates*), but of the return of a part of this nation to their old home south of the Rhine. Julius Cæsar, the highest authority, affirms that 'the power of the Gauls formerly was greater; so that it is credible that there had been an immigration of Gauls into Germany. For what obstacle would a river offer to prevent a nation which had grown great from passing it and occupying and holding the territories of those who had neither a common union nor any national power? Thus Helvetii held the country between the Hercynian Forest, the Rhine, and the Maine, and beyond them were Boii, both of them of Gallic race.'[2] The passage in Cæsar to which Tacitus refers runs thus: 'There was once a time when the Gauls surpassed the Germans in bravery, nay, they even attacked them, and, as they had a surplus population and were straitened for land, they sent colonies over the Rhine. Thus Tectosagi occupied the most fruitful parts of Germany about the Hercynian Forest and settled there.' The Helvetii, like these people, had also widened their borders and possessed a portion of the country on the other side of the Rhine until they were forced by the Germans to surrender it again in order to protect the borders of their own homes from the conqueror. So that we have nothing to do with any hostile irruption nor of any migration of the whole race. But, in any case, this event happened at a much earlier period than that of the implements and coins of Marin, which belong to the time immediately before the people were Romanised, and bring to our view a very advanced state of civilisation and the best productions of Gallic art. The migration of the Helvetii consequently is not at all connected with the introduction of Gallic iron articles into the district of the Lake of Neuchâtel. There can probably be no doubt that iron, like bronze, gradually spread over Gaul, as it did over the rest of Europe. If the people of the bronze age are different from those of the iron age, a proposition which can neither be denied nor has yet been proved, such a change of population is by no means to be connected with the diffusion of iron implements.

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[1] Amongst these we refer to the well-known story in Pliny, respecting the Helvetian Helico (Elicho of the Edit. Dalecampii), the original division of the country, and the power of the district of the Tigurini in the Cimbrian campaign, as well as the notices of Cæsar respecting the abodes of the Helvetii.

[2] Validiores olim Gallorum res fuisse, summus auctorum D. Julius tradit: eoque credibile est etiam Gallos in Germaniam transgressos. Quantulum enim amnis obstabat, quominus, ut quæque gens evaluerat, occuparet permutaretque sedes, promiscuas adhuc et nulla regnorum potentia divisas? Igitur inter Hercyniam silvam Rhenumque et Mœnum amnes Helvetii, ulteriora Boii, Gallica utraque gens, tenuere. (Tacitus, *Ger.* 28.)

Ac fuit antea tempus, cum Germanos Galli virtute superarent, et ultro bella inferrent, propter hominum multitudinem agrique inopiam trans Rhenum colonias mitterent. Itaque ea quæ fertilissima Germaniæ sunt loca circum Hercyniam sylvam Volcæ Tectosages occupaverunt atque ibi considerunt. (Cæsar, *B. G.* vi. 24.)

GEOGRAPHICAL LIST

OF THE

LAKE DWELLINGS IN SWITZERLAND AND THE NEIGHBOURING COUNTRIES.

It was proposed in the early part of this volume, first, to give a detailed account of the most typical lake dwellings, or of those which have been most carefully examined; and, afterwards, to make out a geographical list of all the lake settlements worth mentioning known in the Swiss district. The first part has already been completed; the second now claims our attention.

A catalogue like this, however insignificant the information may appear which in some cases can be obtained, may possibly be useful in two ways: first, as a guide to those who are investigating these singular settlements, and, secondly, to convince antiquaries at a distance that this peculiar mode of living was not a chance, or a temporary fancy, but that it was the settled habit of a widely spread race for century after century. Who shall say how far back this range of centuries extends?

For the sake of convenient subdivision, we will take the country north of the high Alps first, and we will begin at the east. On this plan the Lake of Constance naturally first presents itself to our notice.

LAKE OF CONSTANCE.

Eastern or Main Portion.

Hagenau.—A lake dwelling was discovered here in February 1866 by Mr. Walter, of Constance. Rows of piles were met with, together with stone celts and other implements.

Western Portion, including the Ueberlinger See and the Unter-See.

The shores of this part of the lake are probably more thickly studded with settlements than those of any other Swiss lake.

In fact, here are found happily united all the requirements necessary for the erection of dwellings of this nature. A deposit of shell marl stretching along nearly the whole of its shores and of tolerable breadth; a rich tract of country between the shore and the hills, which rise gently behind; forests of pine and oak; pleasant bays with a gravelly bottom; a great abundance of fish in the lake, and a superfluity of game in the surrounding forests, were circumstances highly favourable to the colonisation of these shores.

Many, if not most of the settlements on this portion of the lake (and probably also of the eastern part, though this has not yet been carefully examined), reached back to the earliest ages, that of the stone period; and till lately they were thought to have ceased to exist before the beginning of the bronze period. Some late discoveries, it will be seen, have proved the incorrectness of this opinion, as in some stations numerous implements of bronze have been found where previously nothing had been met with but implements of the stone age.

The settlements on this part of the lake are almost without exception of considerable extent, and they have this striking peculiarity, they are situated quite near to the shore, nay, in some cases they actually touch it. The fact that implements of all kinds and remains of these ruined colonies are found here in extraordinary numbers, and lying on beds one over the other, together with some other circumstances, indicate that these settlements had existed for many centuries.

UEBERLINGER SEE.

Eastern Shore	**Unter-Uhldingen** **Maurach** **Nussdorf** **Sipplingen**	see pages 107–127.
Western Shore	**Bodmann** **Wallhausen** **Luetzelstetten** **Mainau**	see pages 101–106.

UNTER SEE.

Allensbach and **Hegne**, see page 97.

Markelfingen, see page 92.

Iznang.—A large number of piles are seen both above and below the landing-place, chiefly below. Stone celts were found here.

Hornstad.—A little above the houses of Hornstad there is a great settlement in the part of the lake called the 'Zeller See.' Stone celts and broken pottery were found here.

GAIENHOFEN.—Above the landing-place are the remains of an extensive settlement; part of it is covered up with mud, brought down by a little brook which here runs into the lake. Stone celts are frequently found.

HEMMENHOFEN.—Above the town is a lake settlement in which stone celts have been found. Another settlement lies out in the lake immediately in front of the millstream, and is as large as the whole modern village. The place is called 'im Allmend.' The piles are numerous. Stone celts are found on the bottom, which is gravelly.

WANGEN.—For a description of this well-known settlement, see page 64.

OBERSTAAD.—In the bay between this place and Kattenhorn is a lake dwelling which reaches to the shore, and appears to be as extensive as that of Wangen, though the piles are not very numerous. Antiquities found—stone celts and pottery.

STEIN.—Just where the Rhine runs out of the Unter-See, there is a lake settlement. The piles are at a small distance from the island of Weerd, and near the remains of a Roman bridge which have been found there in the direction of the lake; the piles are scattered and isolated between both banks; the greater part of them have probably been taken up, as they impeded navigation, and must have been a hindrance to the fishermen.

NEUENBURGER HORN.—This place was examined in February 1861, by the Historical Society of Thurgau, and the excavations were directed by Mr. Messikomer. It is situated above Mammern, very close to the Taubmühle. Here a bay extends at the foot of a steep declivity, open to the north-west; the shallow ground is from 200 to 250 feet broad. The piles begin at a distance of about 160 feet from the shore, and appear to extend for about 400 feet, following the course of the shore. The greater part of it is covered with sand or mud. The space over which it extends seems to be more than 39,000 square feet. The piles which are still visible project about a foot above the bottom, and are from three to four inches in diameter. They consist of oak, fir, and alder, but are so rotten that it is impossible to draw up a single pile. No antiquities were found by digging in the ground. All the specimens lay on the surface, and consisted of stone celts, small flint implements, pottery, and bones; one grinding slab, deeply furrowed, was found; but no small bone tools, nor a trace of any material for food. But the force of the water being very great here in rough weather, probably the smaller objects have been washed away. This place, however, affords a rich harvest of stone celts; they have been found by hundreds. It appears as if there had been a regular manufactory of them. And as there was no wide-spread layer of ashes, and only small patches were found here and there, we may conclude that this settlement was not destroyed like Wangen by violence, or at any rate by fire: we may probably also assume that the inhabitants left these lake dwellings of their own accord, and did not carry off with them to their new abodes their old stone implements, but left them behind as useless things of the past; hence apparently they all lie on the surface.[1]

FELDBACH.—This settlement stretches from Feldbach to what is called the jetty, and occupies the whole bay. At the upper part it has been rather covered with sand by the brook which here runs into the lake. Groups of piles are visible in many places. Stone celts and stags' horns are found here.

Above STECKBORN.—This settlement begins near the further houses above the little town of Steckborn, and extends over the bay. The piles project only a very little above the lake bottom. Stone implements are found here.

Above BERLINGEN.—The piles here are not readily discernible, but they begin above the town near the furthest houses, and extend over the bay. Stone-celts have been found all along the shore.

Below ERMATINGEN.—This settlement occupies the bay below the village; the piles in untold numbers project about half a foot above the lake bottom; a considerable portion of the whole area is covered with fine sand. Many stone implements are found where there is gravel, but the ground in general is not gravelly; there are only a few whole round stones. On the contrary, however, there are a very large number of fragments of stone arising from the manufacture of stone celts. One of the celts found was of nephrite. Flint flakes, the refuse from the manufacture of flint tools and weapons, were found in immense numbers; though flint knives and arrow-heads are rather rare. This station appears to have been voluntarily abandoned, for though the ground has been excavated to the depth of three feet, no black earth or burnt wood has been met with, and no other supposition will explain the comparatively few stone implements found here.

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[1] The force of the water alluded to above, is fully sufficient to explain the washing away of the lighter and finer materials of the relic-bed, leaving behind, at the same time, the heavy stone celts, flint implements, &c., exposed on the bottom of the lake. It seems hardly probable that a colony of the stone age, even when first acquiring weapons of bronze (which we know was a scarce commodity) would lightly prize, or readily cast away all their stone implements, the result of so much labour.—[TR.]

LAKE OF NUSSBAUMEN.

At the southern spur of the heights between the Unter-See and the Thur, in the open valley between Stein and Frauenfeld, are three small lakes joined together: the Upper, the Lower, and the Hasen lakes. The two first take rather more than half an hour to walk round them. These lakes are for the most part filled with reeds, and are very full of fish. In the first, which also goes by the name of the lake of Nussbaum, there is a little island, on which Professor von Morlot has discovered piles and other indisputable evidences of a lake dwelling.

NIEDERWYL, near FRAUENFELD, see page 73.

HEIMENLACHEN, near BERG, in THURGAU, see page 325.

KRÄHENRIED, NEAR KALTENBRUNNEN, IN THURGAU.

In the 'Anzeiger,' for January 1876, No. 261, page 654, Mr. Burkhard Raeber has published a notice of a pile dwelling imbedded in peat in this locality. Krähenried lies between Kaltenbrunnen, Haghof, and Eppenstein. Several small streams from the neighbouring hills run down to Krähenried which is partly under water. A brook, which is never dried up, runs from the moor near Eppenstein, and after passing several small places joins the Thur at Amlikon.

In one of the pits, not far from Kaltenbrunnen, the relic-bed, which is five or six feet deep, contains charcoal, pottery, hazelnuts, and piles, all intermixed. Many piles may be seen still standing in water, evidently belonging to a lake settlement. Some of the lower ends of the piles which had been dug out showed decided traces of having been sharpened by stone celts. The ornamentation of the pottery consisted in many cases of regular rows of impressed dots; these fragments probably belonged to well-finished vessels, as the surface had been smoothed, and the clay was, in general, not mixed with quartz sand. A well-made celt of serpentine, four inches long and two inches broad, was found here.

The turf-diggers informed Mr. Raeber that for many years they have found remains of piles. Celts, pottery, hazelnuts, charcoal, and bones were frequently met with, but as they were thought of no value they were thrown aside. One of the labourers found what, by his description, was a dagger, but after having been used as a knife, this also was afterwards thrown away.

LAKE OF PFAEFFIKON.

PFAEFFIKON IRGENHAUSEN HIMMERICH (?) ROBENHAUSEN RIEDBUEHL (?)	see pages 41–63.

LAKE OF GREIFFENSEE.

No settlement was positively known in this lake until February 1866, when the water was very low, and an actual lake dwelling was discovered by Mr. Messikomer. It lies in the immediate neighbourhood of the brick-kilns of Riedikon, and extends over about an acre. It is nearly a hundred feet from the shore, and the depth of water is from three to four feet. The antiquities found here are flints, stone celts, broken hazelnuts, pottery, and grains of barley. The bottom is covered with a mass of broken stones.

A second settlement lies between Greiffensee and Riedikon, near the junction of the Aabach and the lake just opposite to a little wood called 'Jungholz.' This lake dwelling is situated on a small rise called 'im Storen,' and is not joined to the land. It belongs to the stone age and does not appear to be of any great extent.

LAKE OF ZÜRICH.

MAENEDORF.—In the winter between 1843 and 1844 the water was very low, and advantage was taken of this to deepen the harbour near the last houses at Mänedorf in the direction of Uetikon. The place of excavation was only a few paces from the present bank. Before digging far, the workmen came upon a blackish alluvial earth, which, when thrown out, gave a peculiar odour; it had been formed by the decay of wood and animal matter, and was advantageously used as manure on the neighbouring meadows. In this earth were found bones and horns of animals, many kinds of implements, and a number of very perfect stone celts, some of which are in the museum of the Zürich Society, but many specimens were broken to pieces or thrown again into the lake; they are all of pretty spotted serpentine, and are remarkable for their size, for their careful workmanship, and for the fact that the posterior part, after having been ground, has again been hewn and made rough. From information obtained by the author after repeated visits to the place, it was very evident that a lake dwelling formerly existed here, and this was mentioned in the first report on the lake dwellings made to the Zürich Antiquarian Association. Thus the matter rested, till the early part of the year 1865, when circumstances occurred to confirm the opinion expressed several years before. It was found necessary to deepen the small harbour where the antiquities had previously been found, and a space of about eighty feet long by thirty feet broad was excavated to the depth of about four feet. In doing this the regular substructure of the lake dwelling came to light. The piles, some of oak, and some of fir, stood so close together that not even a single pile could have stood between them. The antiquities found during this excavation are precisely similar to those of other lake dwellings of the stone age, such as Meilen, &c. It is, however, proved that this settlement lasted till the beginning of the bronze age, as a portion of a crucible exactly like those found at Robenhausen both in shape and material was discovered here.

ZÜRICH.—In the first edition of this work a short notice was given respecting the pile-dwellings near this city, taken from Dr. Keller's second report. Very little, however, was at that time known respecting them, and the notice was little more than an indication of their existence. Since then, in the 'Anzeiger' of April 1872 (No. 2), Dr. Keller has given much fuller particulars of three localities near this city. The following is abridged from his account:—

The three localities are:—1. The Bauschanze (as it is called), near the Hotel Baur au lac. 2. The small Hafner. 3. The large Hafner.

I. The 'Bauschanze,' and the adjoining parts of the bank to the south. Piles have for the last ten years been known to exist here. Numbers of them were brought up when the bottom of the lake was lowered by the mud-machine, but at that time it was not known that the settlement extended so far to the south. Probably the 'Bauschanze' was originally a 'Steinberg'; the surface is nearly covered with fragments of pottery, some of which are unquestionably of the bronze age.

In this settlement, as well as in those of the small and large Hafner, which are near to it, there is a peculiarity of construction which is very interesting, and by no means common. As the lake-bottom consisted of very soft loamy mud, without sufficient consistency to hold the piles firmly, if driven into it in the usual manner, the upright piles were joined, by a kind of mortise and tenon arrangement, to cross or horizonal beams lying on the bottom, thus forming a kind of frame at the bottom of the water. Numbers of these horizontal cross beams of different sizes have been brought up by the mud-machine. They are oaken stems split in two, with the flat portion downwards (see the annexed woodcut), and with rectangular mortise holes made in the top to receive the tenons of the upright piles.[1] The greater branches of the oak stems have been cut off and the ends are rounded. These frameworks, if they may be called so, are chiefly found in deeper water, and for this reason, as well as from the workmanship, they appear to belong to the bronze age.

Fig. 34.

II. The small 'Hafner' (like the greater 'Hafner' near it) appears to have received its name from a local tradition, that many centuries ago, the potters of Zürich used to take all their 'wastes' or defective pottery to these two places and throw them into the lake. The small Hafner lies exactly in front of the outlet of the lake. The east side is nearly 200 English feet from the present shore, and probably 500 from the ancient bank, so that there cannot have been any bridge connecting it with the land. In shape it is somewhat round, and the area is about an acre and a half; when the water is very low it is about three feet deep, but when it is high there are eight feet of water above it. It is the only one of the stations near Zürich which never appeared above water, and in consequence of this the implements and bones were in good preservation, and tolerably free from the calcareous tufa which covers all the specimens from the other localities. The bottom of the lake is a whitish loam with a thin bed of whitish shell-marl running through it.

The surface of this shallow has a few stones lying upon it, which evidently have been brought here intentionally. The piles were not visible on the whole surface, but where they occurred they were rather close together—about a foot or eighteen inches apart. They were both of round and split wood, and were made out of the stems of pines, firs, oaks, beeches, &c., such as are now growing in the neighbourhood. Some piles were sharpened by fire and others by stone celts. The horizonal beams, already described in the notice of the 'Bauschanze,' were lying about in groups, and in the holes might still be seen the remains of the upright piles.

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[1] See woodcut, fig. 3, p. 5, of this volume, under the description of the 'General Form.'—[Tr.]

The relic-bed was buried one or two feet deep in the mud, but very singularly a number of implements were found lying on the surface of the bottom, such as mealing-stones, corn-crushers, some few stone celts, and a quantity of pottery. This fact, which was also noticed at the other stations, leads to the supposition that these settlements had been several times burnt down and re-erected. Amongst the implements found here the following may be noted,—stone celts, hafted in various ways, and also celts which evidently were intended to be held simply in the hand.

No flint celts were found, as flint does not occur in this district in sufficiently large masses; but smaller flint implements occurred, such as flakes, knives, saws, scrapers, and small arrow-heads, and pointers, polishing or grinding stones.

Corn-crushers and mealing-stones, as well as some of the wheat and barley which they were intended to grind—some of it still remained lining the pipkins with a coating of burnt porridge. Several implements were found both of horn and bone. Pottery was abundant, mostly in fragments, but of almost every variety, from rough large vessels to the more finished ones. Some of the larger ones must have been three or four feet in diameter; a few of the smaller vessels had handles and one or two also had spouts. The ornamentation is very varied, and consists sometimes of a sort of ring fastened on, sometimes of lines scratched in and filled with chalk; the zigzag lines are very common. The smaller vessels are for the most part blackened, either by graphite or from being exposed to a smoky fire. The fragment of a crucible, like that found at Robenhausen, occurred here; and also, for the first time in Eastern Switzerland, one of the well-known clay rings, or supports for the earthenware vessels, with a pointed base.

A few *bronze* implements were brought up by the mud-machine: such as a piece of molten bronze, a ring, a pannikin with a round top, a large pin for fastening the clothes, a dagger, a celt, and a sickle.

A few tools of *iron* were found, belonging to the Helvetic period, showing that the settlements were founded during the stone age, but continued through the bronze age. Roman tiles occurred, which certainly are difficult to account for, as no Roman utensils are to be found, either at the two Hafners or any other lake dwelling, although they would have been most useful to the settlers.

III. The great Hafner is a little further off in the lake; it is distant from the small Hafner about 1,000 feet, and from the present shore 900; it would probably be 1,100 feet from the ancient shore: the channel between it and the land is more than sixty feet deep.[1] The form is oval, the area a few acres; the longer axis runs in the same direction as the lake. As far as we could ascertain, about half the surface is covered with piles. When the water is of an average depth the Hafner is covered five or six feet deep. The bottom is similar to that of the small Hafner. In passing over it with a boat, a number of stones, from one to eight lbs. weight, may be seen, some round and some angular, all evidently brought from the shore. The horizontal oaken beams, with holes in them, may be seen in several places. The relic-bed is about a foot beneath the surface of the bottom: it is of a blackish colour, and consists of charcoal, half-burnt branches, and chips, burnt twigs, straw and rushes, and a great quantity of bones and pottery. Grains of wheat and barley, and seeds of the raspberry were found, and hazelnuts; and on the surface broken pottery and stone implements.

UETIKON.[2]—South of Meilen, where the first pile settlement was discovered, and about two miles and a half distant from it, is the village of Uetikon. A lake dwelling was discovered here in the year 1859, of some extent. A large number of piles were to be seen, some of which seemed to reach to the shore. The excavations, which were undertaken by the Zürich Association, were to a certain extent favourable, and a number of objects, similar to those found at Meilen and Zürich, were discovered; viz.: implements of stone, bone, stag's horn, and wood, but not a single object of bronze. Unfortunately, further examination of the place was prevented by the erection of a landing-place for the steamers, and also of chemical works.

WOTTISHOFEN.[3]—In this district, which lies on the left shore of the lake of Zürich, and nearly two miles from the town, the remains of a pile dwelling were discovered at a short distance from the shore, on what is called the 'Haumessergrund.' Both piles and pottery have been brought up by the fishermen. But now the remains of the settlement are covered over with mud, as the steamers pass over the place several times in the day, and wash up the soil from the lake bottom. It is quite impossible to make any excavation here.

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[1] In the Anzeiger, as Dr. Keller has informed me, this deep channel was by mistake said to be between the smaller Hafner and the shore, whereas it is actually, as stated above, between the larger Hafner and the land.—[TR.]

[2] Communicated by letter from Dr. Keller.

[3] From the same.

There can be no doubt that the Lake of Zürich, like that of Bienne, was originally surrounded by pile settlements, but the piles have long since been pulled up by the fishermen.

LAKE OF ZUG.

Several lake dwellings have been found on the banks of this lake. See page 128.

LAKE OF BALDEGG.

The late Col. Schwab found the remains of five pile dwellings on this lake; one of them is situated not far from the mouth of the Aa. The piles are spread over about 14,500 square feet; they are not numerous; some of them may be observed at a depth of fifteen feet just where the lake becomes suddenly deep. Fragments of pottery are found here. The other four settlements are situated close to the bank, on what is now dry land, and can only be investigated by regular excavation. See the account of the recent excavations in this lake page 318.

LAKE OF SEMPACH.

The earliest information as to pile dwellings in this lake was communicated by the Rev. Jos. Boelsterli. In the year 1806 the water was six or eight feet lower than usual. The strand then became dry for about 200 feet in breadth, and a number of piles were exposed which had previously been covered with very shallow water. These piles are said to have been a foot in diameter, and, when drawn up, to have been twelve feet long. About forty piles were found together; some Celtic weapons (described in the seventh volume of the 'Geschichtsfreund') and also pins and other implements were found here.

Subsequently the late Colonel Schwab submitted the lake to a more complete examination. The settlements run along the shore, and are not broad, as the lake becomes deeper at some little distance from the shore. The remains of the lake dwellings do not lie deep in the ground, for the peat on the average is only a foot thick. The stone implements of Schenken and Eich do not differ in material from those of other settlements, but they are especially remarkable for careful workmanship; in fact, they are amongst the best things of the kind found in the lake dwellings. They are all deposited in the Antiquarian Collection at Lucerne.

At the north end of the lake of Sempach, a tongue of land, about 300 feet broad, runs nearly 600 feet into the water, and appears to consist of gravel from the neighbouring moraine of Mariazell, which forms the termination of the lake in that direction. Here at almost every step fragments of Celtic pottery are met with. The lake dwelling itself is seen in the shape of a few piles in the neighbourhood of the bank.

Very near this place, in dry ground, hardly twenty feet from the water, and only a foot under the surface, a number of antiquities were discovered; they consisted of nineteen bronze armlets, one bronze sickle, two bronze celts with shaft flanges, one broken stone hammer, and two corn-crushers. At another place, a short distance off, there was found a human skull, also a lance-head, a hairpin, and a gouge of bronze, together with pottery, wild boars' tusks made into tools, and the bones of pigs. But neither the owner of the land nor the antiquaries have been able to decide whether these specimens really belonged to a lake dwelling, or had been brought here in the earth from some neighbouring locality. The presence of a number of horses' ribs, which were found here, may be explained by the supposition that this was the place where they were skinned. The small but singular earthenware vessel, Plate XXII., fig. 15, was found here.

The following is a list of the chief settlements in the lake of Sempach:—

SEMPACH.—EICH.—This settlement is now entirely on dry land; numerous piles were found when excavating an area of about 58,000 square feet. Flint flakes and arrow-heads, a bronze celt, and a wooden club were the antiquities discovered here.

SCHENKEN.—This station contains about 97,000 square feet; about half of which is now on dry land. The specimens found here were flint arrow-heads and fragments of pottery.

LITTLE ISLAND.—On the north-west of this little island an area of about 200 square feet, formerly covered with water, is sparingly studded with piles. The antiquities found here consist of pottery, stone celts, flint flakes, and arrow-heads, and the head of a bronze hairpin.

Mariazell.—The whole of this settlement, which contains about 29,000 square feet, has been dry since the level of the lake was lowered in the year 1806. Probably the bronze implements mentioned above were found here. The antiquities found by the late Colonel Schwab consist of flint flakes, two stone spindle-whorls, a stone celt, and an iron knife.

Margrethen.—**Nottwyl.**—In front of this place, at a depth of fifteen feet, there is a double row of piles.

Between **Nottwyl** and **Sempach.** Piles are to be seen at the mouth of a brook.

LAKE OF MAUENSEE.

This little lake is connected with that of Wauwyl, which is still smaller. The late Colonel Schwab found piles at two places, viz., opposite to Wauwyl and Kaltbach, and he was convinced that an excavation on the little island would reveal the remains of a settlement. Flint arrow-heads were found at the locality first named.

LAKE OF WAUWYL.—See page 82.

LAKE OF INKWYL.

About an hour's walk south of the little town of Wangen, not far from Soleure, the lake of Inkwyl lies in a boggy plain; it is about twenty minutes' walk in circumference, from eighteen to thirty feet deep, and is covered at the bottom with mud. This little sheet of water abounds in fish; it is completely frozen over every winter, and is not open again till April. In the middle of it there is an artificial island, rising about ten feet above the level of the water, tolerably round, and about fifty feet in diameter, over which a wooden stage extends about six or seven feet underground, made of cross pieces of fir-wood (now indeed quite rotten), and resting on oak piles from three to four feet apart. There is a layer of black earth about one foot thick which covers it, and which contains the greatest number of antiquities. Immediately under the cross beams there is a bed of white lake-marl filled with many small shells, which is a proof that the platform with the huts upon it stood above the water, and that the piles which supported it had been driven into a shallow part of the bed of the lake.

This settlement was discovered by Professor von Morlot in September 1854, and described in the work 'The Lake Dwellings of Moosseedorfsee, in the canton of Bern,' by A. Jahn and J. J. Uhlmann. The results of the subsequent excavations, undertaken by Mr. Amiet of Soleure, in November 1857, and by Mr. Roth, the proprietor of the island, in April 1858, were published by Mr. A. Jahn in the 'Anzeiger für Schweizerische Geschichte und Alterthumskunde.' 1858, No. 4. In many points this station seems very similar to the Irish crannoges.

The implements found here were stone celts of nephrite and serpentine hafted with stag's horn; many cutting instruments of flint, barbed arrow-heads of the same material, corn-crushers, and slabs of sandstone for grinding the hatchets; pointed tools of all sorts, made out of bones, especially those of the stag; wild boars' tusks, some of them perforated; an immense number of fragments of pottery, some made from coarser and some from finer materials, and in some cases ornamented with patterns of lines; fragments of bowls of potstone, clay spindle-whorls, some bronze fish-hooks (?), and, lastly, an iron implement which appears to date from the Roman age. Some objects of very soft sandstone are particularly interesting, which are drawn and described in the above-named number of the 'Anzeiger.'

Plate XXXIX. fig. 2 represents one of the small earthenware rings used as net-sinkers. This specimen has the furrow still remaining which was worn by the cord. It seems now clear that these smaller rings were net-weights, while most of the larger ones were supports for the conical-footed earthenware vessels. The large rings with very small openings and the small rings with very large ones are somewhat difficult to understand.

BURGAESCHI SEE, in the canton of Solothurn.

Mr. Jenner has informed Dr. Keller that he has ascertained the existence of three lake dwellings in this little lake, one of which appears to belong to the bronze age. Where the peat is being dug at the present time only implements of the stone age are found. The peat is twelve feet or more thick. This little lake is about two English miles in circumference, and the shore is in part formed of peat.

LAKE OF MOOSSEEDORF.—See page 35.

LAKE OF BIENNE.

The plan drawn on Plate CV. shows the situation of the pile-dwellings known in this lake. It is chiefly by the exertions of the late Colonel Schwab that we have obtained so much information respecting them. The letters S and B indicate settlements of the stone and bronze periods, but here in this lake we shall find two other letters. I, indicates that the settlement was in existence during the iron age, and R, that a number of Roman remains are found in its ruins. Whether settlements of this nature were actually inhabited in Roman times remains yet to be decisively proved.

Twenty-one settlements were known on this lake, when the first edition of this work was published. As will be seen by the plan, these twenty-one settlements are all numbered; since then a few more have been observed; these newly found stations are not numbered; a few particulars will now be given of those which are of most importance.

NIDAU.—See page 137.

GRASEREN.—An inconsiderable settlement very much covered with mud, probably only occupied by a small number of inhabitants. It lies about 200 feet from the shore. The following antiquities were found here :—A dagger, the handle ornamented with silver wire; knives, sickles, and other implements of iron; mealstones, slingstones, and corn-crushers.

SUTZ.—This place is about half an hour's walk from Nidau; Roman buildings have been found in the neighbourhood, viz., in the Schlattwald and on the banks of the lake below the church. About 100 or 150 feet from the shore, piles are seen like those of Nidau, about six feet under water, and hardly projecting a foot above the bottom. The ground here consists of loamy mud, but in parts it is covered with roundish gravel and granite stones, which the inhabitants think have been collected from the neighbouring cliffs and sunk here; the whole space, however, about 2 acres in extent, where the heads of piles are occasionally seen, is only a trifle higher than the surrounding parts. The piles, so far as they have been examined, appear to be of oak, and seem to be thicker than those of Nidau. No horizontal balks have yet been found here. The distance between the piles seems very irregular; sometimes they are a foot apart, sometimes several feet, and sometimes only six inches; they run occasionally parallel with the bank, and then again they take a turn, and incline towards the shore in either a straight or curved line. The wood found here shows traces of burning, and the few earthenware vessels met with were also filled with charcoal. A bronze celt was found here which had the half of the shaft between the flanges turned to charcoal. In short, the appearance of most of the specimens, together with the black muddy bottom, may be taken as a proof that the settlement here was destroyed by fire. To the antiquities already mentioned may be added a bronze sword, Plate XC. fig. 4; two iron lance-points, Plate XC. fig. 2, and a millstone made after the Roman fashion. Plate XC. fig. 1 shows two views of a kind of hammer-pick, made of serpentine, with a hollow in the middle to allow of its being held firmly, and Figs. 10 and 11 are two rods made of oak, which evidently have been lances: the section is shown on one side of the figures. Several of these weapons have been found both here and at Nidau. Both ends were brought to a point; they were not made of whole branches, but were portions of split stems of oak. There was also found a flint tongue or flake five inches long, and one inch broad, flat on one side, and on the other shaped like a roof. Whether it was a lance-point of very early age, or was destined for some other purpose, we will not attempt to decide. Fig. 14 is the sketch of a very singular bronze hook with three blunt teeth: the use of this implement is unknown.[1] The bronze sword drawn Fig. 7 was found between Sutz and Lattringen.

Supplement to Sutz.

The notice of this settlement in the first edition was given when the place had been only partially examined. It is, however, here reprinted almost entire, as it seemed better to supplement it by an independent account of the later excavations. It will, of course, be seen that the views expressed ten years ago have in a measure to be altered. The following is the account given in the 7th Report of the Zürich Society of Antiquaries, by Dr. von Gross.

'This is one of the largest settlements in the lake of Bienne; the piles are now known to extend over an area of about six English acres; and a bridge nearly a hundred yards long and more than forty feet wide, joins the settlement with the shore. In the part furthest from the land there are several well defined "Steinbergs" made of masses of broken stones and organic rubbish. Between these elevations the bottom is formed of sandy mud, and is covered with rushes and vegetation of all kinds. As the place had not been carefully examined and as the relic-bed was entirely on the surface and quite accessible, I had hoped for very favourable results. But unfortunately my expectations were not realised, and with the exception of a portion in the middle of the station (immediately opposite the château of Sutz) the relic-bed was very poor in remains of human industry. The cause of this may probably be that this settlement appears not to have been destroyed by fire like most of the other stations in our lake (as in fact from the burnt specimens formerly found here appeared probable), but that it had been voluntarily abandoned by its inhabitants, who, when they went away left nothing behind them but the remains which, by chance, had fallen into the water during their residence here. For on examining the relic-bed it is very soon seen to differ from that of other stations in being more earthy and containing much less charcoal and carbonaceous matter. It is from 4 to 16 inches in thickness.

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[1] We are reminded by this object of a 'skeleton key.' Is it possible that it was a key to some very primitive lock?—[Tr.]

'The owner, M. de Rutte, having kindly allowed the excavations to be carried on, a number of men were set to work for about a fortnight and several specimens were discovered, some of considerable interest.

'*Objects of Stone.*—Many fragments of hatchet hammers, perforated like those from the settlement of Greng. Some celts of the common form, all of them small and rather inferior both in size and finish, to those found at Lüscherz. Only two little specimens are of eastern nephrite. A number of flint flakes, several of which have been carefully chipped to make them into lance-heads or knives. A quantity of little perforated discs, intended to hold a wooden stem, and meant for spindle-whorls, and several little perforated stones, both long and flat in shape, which evidently have belonged to a necklace.

'*Objects of Stag's horn.*—Amongst the numerous celt-haftings, many of them are quite unlike any others I have discovered in the lake of Bienne. They are notched in the form of a V in that part (opposite to the celt) which was intended to join the wooden handle. This notch was probably intended to receive a wooden wedge, so as to make the hafting more secure.'

Plate XLIII. Figs. 15, 15*a* represent a spoon made out of part of a horn; it is like our modern wooden spoons. Many hammers of the common form were also found, but remarkably small. Plate XLII. fig. 10 is a sketch of one of them.

'*Amber.*—Two very well-made beads of amber, they were taken from the middle of the relic-bed. If I mistake not this is the first time that amber has been found in any dwelling of the stone age.

'*Objects of Wood.*—Many vessels of different sizes, some of which have handles, and a beautiful bow of yew, quite perfect, 5 feet 3 inches long.[1]

'*The Pottery* is only represented by fragments of vessels coarsely manufactured, generally ornamented round the neck with bands like projecting cords, made with the fingers; or with circular furrows, made by pressing a cord into the soft clay before it was baked.

'*Animal Remains.*—The bones of animals found at Sutz do not seem to differ essentially from those of Lüscherz. I may, however, mention some perfect skulls of the stag, the dog, and the goat, &c., also an ox's skull, quite perfect, which seems to have ornamented the entrance to a hut, as it still had round it a small cord evidently intended for suspension.

'*Human Remains.*—Three skulls and some other bones were obtained by the workmen, from an area of about 21 square feet, at a depth of about 20 inches. These skulls have the same characters as those of Lüscherz, and all appear to belong to the Lion type. The one which is in the best state of preservation is interesting, as it has a fracture in the occipital region, and the cranial arch has been broken in, an injury which would be fatal to the individual. The rounded form and the size of this fracture lead me to presume that it had been caused by a blow from one of the hatchet-hammers already described.

'A few more antiquities may be added, which were found at Sutz, viz.:—

'Plate XLIII. fig 7.—A double pointer of stag's horn.

'Plate XLV. fig. 10.—A small stag's horn hammer.

'Plate LVIII. fig. 9.—A bronze fibula.

'Plate LXXXVII. fig. 7.—Basketwork of a peculiar construction.'

LATTRINGEN.—Near this village, which is about ten minutes' walk from Sutz, there are two places in the lake where piles are seen. One of them lies immediately in front of the little harbour, is about 3 or 4 acres in extent, and approaches to within 20 feet of the shore. The depth of the water is from 6 to 8 feet, as is generally the case in this neighbourhood.

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[1] This is the second specimen which has been found in our lake dwellings. The first was obtained by Mr. Messikomer at Robenhausen, and is now in the Museum at Zürich.

It does not appear that the settlement was formed on any artificial elevation of the bottom. The piles are placed very irregularly, and project only a few inches from the bottom, which is unfortunately very much covered with mud; and this renders the investigation somewhat difficult. The antiquities found here consist of a bronze dagger, Plate XC. fig. 3; a bronze shovel-shaped celt; a bronze hook, Fig. 13; a spiral ring of bronze; some corn-crushers made of pebbles; a stone with cavities both above and below, and which doubtless served as a mortar or mealing-stone for crushing corn, like that from Nidau, drawn Plate XXXVIII. fig. 5, and some coarse pottery.

Supplement to Lattringen.

The above account is the substance of the notice respecting this settlement by the late Colonel Schwab, and is a literal reprint of what was given in the first edition. It will be noticed that most of the antiquities obtained by him belong to the bronze age. A later examination of the station by Dr. von Gross affords somewhat different results; the antiquities he obtained here appear to have been exclusively of the stone age. The following is a literal translation of his notice of the settlement:—

'The piles may be seen immediately in front of the port of the little village of Lattringen. They covered an area of rather more than five English acres. Four bridges connected it with the shore; of which the chief one was about 65 yards long and 13 or 14 feet broad.

'All the specimens found here belong to the stone age and are very similar to those from Lüscherz. They are as follows:—

'A large number of stag's horn haftings, many of which have a peculiarity which hitherto I have not noticed elsewhere. Near the hollow for the reception of the celt there are five or six shallow notches, parallel with each other, cut in the horn with the flint saw; these I consider as marks of ownership. Another specimen has at its base a rectangular opening, in which was fixed a wooden handle.

'A large harpoon, nearly 8¾ inches long, Plate XLII. fig. 1. It has eleven barbs, is perforated at the base, and has been skilfully made out of a fragment of stag's horn.

'Many implements of bone and horn; one of them, made into a dagger, was of bone fastened into a handle of stag's horn, Plate XLII. fig. 5. Fig. 18 is a little bone awl or pointer, also hafted in stag's head.

Above **Lattringen.**—About 500 or 600 feet from the last-named settlement there is a circular elevation in the bed of the lake, about 40 feet in diameter, where piles are found. This submerged mound is about 8 feet below the surface, while between it and the shore the depth is 10 feet, and on the other side towards the lake the water is 13 feet deep. There appears to have been here quite a low dam with piles, joining the settlement and the land together. The piles, which are scattered, and few in number, project about a foot or a foot and a half above the bed of the lake. The bottom is very much covered with mud. The horn of a roe (?) was dredged up here, and also pottery, which in shape and quality is precisely similar to what has been previously described.

The above is the notice of this settlement in the first edition. It has since then been examined by Dr. von Gross; but in the 7th Report of the Zürich Antiquarian Association he says very little about it. The extent is less than an acre, and the most interesting specimens found there are some fine lance-heads of flint, and a hammer-hatchet of serpentine, very well finished, and more than 7 inches long; it is sharpened at both ends, and has an oval hole in the middle for the handle.

GERLAFINGEN (*Gérofin*), *by Dr. von Gross.*

There are two settlements here, an upper and a lower one, the upper one is very small, hardly extending over more than half an acre; it is joined to the mainland by a bridge about 100 yards long, and about 8 or 9 feet broad. The only things found here were some stone celts and flint flakes.

The lower station is much larger, and covers an area of about 4 acres. The row of piles connecting the settlement with the shore is about 175 yards long and 10 feet broad.

Notwithstanding the almost entire absence of the relic-bed, which has probably been washed away by the waves, I obtained on the surface, and amongst the piles, some interesting specimens, which deserve to be recorded:—

Several nephrites and jadeites, one of which is in shape like a long chisel 4 inches in length. According to Professor Fischer of Freiburg (Baden) the density is 3·01. It is the most important of all the specimens of nephrite yet found in our lake dwellings, in fact its beautiful bluish-green tint, with scattered reddish-yellow spots, make it look very like the Siberian nephrite of Batongol. Professor Fischer has a fragment which was brought direct from that country. Now, the fact that the isolated block of nephrite found at Schwernsal, in the early part of this century, is perfectly identical with the nephrite of Siberia, may possibly furnish us with some data as to the route which was followed by the first inhabitants of this country in their migrations. A second celt, of the same mineral, is of a whitish-grey colour, exactly like the little figures of nephrite and jadeite which are brought from China.

A wooden spoon, very cleverly made out of a single piece of yew, is drawn on Plate XLII. fig. 14. A miniature canoe, made of fir wood, was apparently a child's toy: it is 9 inches long, and 1½ inches wide, and is merely a reproduction of the lacustrine canoes of the stone period, Plate LXXXIII. fig. 9. Two metal chisels, about 6½ inches long, Plate LIX. figs. 8 and 9, are interesting as they are made of *copper*,[1] and it is pure copper, without any traces of tin, lead, or silver. This fact (namely, that implements of pure copper have been found in a stone age station) may be adduced in favour of the opinion held by some antiquaries, that there was an age of pure copper *between* those of stone and of bronze.

A pin, with two prongs, 8½ inches long, Plate LX. fig. 2; it may have been used for the hair or as a clothes-pin. The two prongs, ornamented with lines in patterns and bent into hooks at the end, are united a little below the head, which is flat, and has a small perforated projection at the top; at some distance from the head, the two prongs are again united by a cross-bar to prevent their spreading. This specimen, which is, I believe, unique of its kind, is evidently the production of foreign art—probably Etruscan.

A celt, of a shape very rare in the settlements of the bronze age, strictly so called, but which is tolerably common in the tumuli. It is short, flattened, with a wide cutting edge, and with rudiments of wings. It is evidently the primitive type of bronze celts, which, when brought to perfection in later ages, were developed into the massive celt with four wings of our lake dwellings.

A small triangular dagger, 4 inches long, ornamented with raised lines running parallel with the cutting edge, and with two rows of rivets at its base, Plate XLVII. fig. 7, and a small bronze lance-point, Plate XLVI. fig. 9. Lastly, I will mention two specimens of coarse earthenware, one in the form of a cup, neatly made, and with a handle; the other is a porringer, with the sides rather expanded, and having, externally, two projections near to each other, both of which are perforated.[1]

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[1] Professor de Fellenberg, who has kindly analysed them, says that he has never yet met with implements of such pure copper, and he thinks that they probably had been brought from the North.

Amongst the very latest discoveries here are some large bone pins, all of them curved, and several with rather flat heads. They are drawn, Plate CL. figs. 1, 2, and 3. Also, a singular bean-shaped implement, made out of a wild boar's tusk, with a perforation at each end; it is sketched as seen on either side fig. 7 of the same plate. A good chisel, probably of nephrite, was also found here; it is drawn fig. 8.

Below HAGENECK.—Above the village of Täuffelen, in a direct line below the houses at Hageneck, a number of rather small piles are to be seen about 100 feet from the shore and at a depth of about 4 feet. They project from the muddy bottom about a foot or a foot and a half, and probably cover an area of about an acre. From the depth of the water this place did not offer any good results, and consequently it has not been thoroughly examined. Some fragments of pottery, however, have been found there, and these, together with the piles, prove that it was the site of a settlement.[2]

PETER'S ISLAND.—This island, which in ancient times probably bore the name of Ubinowa ('Obere Aue,' the upper island), in contrast with Nidau (the lower land or island), has on the south side the remains of an extensive settlement. The piles are from one to two feet apart, and stand in rows which for the most part run parallel with the bank, at a distance from it of about 30 or 40 feet; the breadth of the piled space here is hardly as wide, because the lake-bottom suddenly deepens. The bottom is exceedingly muddy, so that there is great difficulty in investigating it. The piles project about one or two inches from the bottom, and probably extend over two acres. One object found here especially claims the attention of antiquaries; it is a canoe or boat (Einbaum) sunk in the mud at the north end of the island, about 50 feet long and 3½ or 4 feet wide, so that it must have been made out of a colossal trunk. As it is filled with stones, and lies near a heap of stones, there can be no doubt that it went down from overloading. We have, therefore, here a matter-of-fact proof that the places in the lake selected for settlements were really covered over intentionally with a bed of stones.

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[1] It may not be amiss here to mention that the lower station of Gerlafingen goes also by the name of Oefeliplätze. See the *Anzeiger* for 1871, p. 282.—[TR.]

[2] Although there is very little to add to the above account of Hagneck, as it appears to be called now, yet it may be well to transcribe the few lines referring to it in the 7th Report; they are as follows: 'This is a very small station, situated at a short distance from the mouth of the new cutting made to bring the waters of the Aar into the Lake of Bienne. It is hardly a quarter of an acre in extent. It is joined to the above by a bridge about 65 yards long and 13 feet wide. The piles, which are small, are chiefly covered with sand and mud, and the relic-bed, where not completely washed away, is very thin. Nothing of interest has been found here, except some stone celts and coarse pottery.'

The bronze pin drawn Plate XXXIX. fig. 4 was found here.

Supplement to Peter's Island, by Dr. von Gross.

Since the publication of the first edition, M. de Fellenberg has shown that a pile-settlement was situated to the north of the island. A baked clay ring, found here, led to the supposition that the station belonged to the bronze age.

Now this idea is completely confirmed by the discovery of many bronze objects found in the neighbourhood of the piles, upon a kind of promontory made of a mass of sand and rolled pebbles, which, starting from the north-east corner of the island, stretches out for some hundreds of feet.

The following is a description of some of these specimens:—

(1.) A bronze knife, the blade of which is curved, about 5 inches long.

(2.) A little chain of the same metal, Plate LVI. fig. 4, made of a series of rings joined together, some of them directly, and others by means of a thin plate of bronze, bent in the shape of a circle. The ring, for suspension, has an appliance in the shape of a small rod, 1½ inches long, which apparently has been used to fix the chain to the head-dress or to the clothes.

(3.) An object of ornamental dress, of cast bronze, probably of Etruscan origin, Plate LVI. fig. 3. It is made of a triangular plate, with undulated edges, and perforated with several rows of holes, placed so as to look like a number of rings soldered together. From each of the three holes at the bottom of the triangle, there are suspended, by means of an intermediate ring, a pair of pendants, all of the same form and size. These appendages are made of thin pieces of flattened bronze, widened at one end into a crescent shape, and at the other having a ring by which they were joined to the ornament. These pendants, when they clashed one against the other, evidently must have given out a ringing sound, and it is to be presumed that these ornaments must have been worn by some person of distinction.

No similar specimens have yet been got from our bronze age stations, unless the triangular perforated plates found at Cortaillod and Möringen, belonged to ornaments of this nature.

But ornamental objects, like those just described, have been found at Hallstatt, only differing from these, as they are large, and the ornamentation more complicated.[1]

(4.) Several fragments of swords, celts, and sickles.

(5.) A pair of pincers, for taking out hair, like those found in other settlements.

LITTLE ISLAND.—(Kanincheninsel). On the western side of this little island, portions of Roman roofing tiles and fragments of pottery have been found in great numbers; but on the south side, the former steward of Peter's Island noticed a group of piles projecting about 2 inches high above the mud bottom, which in all probability mark the site of a lake settlement. The late Colonel Schwab investigated this locality, and found objects of the stone, the bronze, and the Gallo-Roman periods all mixed together. Forty Roman coins have been discovered here. The little gold ornament drawn Plate XC. fig. 5, was found at this place.

Above LIGERZ.—This settlement is about 40 or 50 feet from the shore; the extent is about 3,850 square feet, the average depth of water is about 8 feet; the piles are scattered and thin.

TWANN (*Douanne*), *by Dr. von Gross.*

Last year, some workmen employed in digging a well near the quay, at Douanne, found, at a depth of 15 or 20 feet, a blackish bed, containing piles, pottery, and stag's horn objects. As I happened to be on the spot, there was no difficulty in deciding that these were the traces of a lacustrine settlement of the stone age. As the depth of alluvial earth which covered the piles rendered it impracticable to excavate further, I was obliged to be satisfied with proving the existence of this station, which, hitherto, had not been even suspected.

VINGELZ.—This settlement is situated about 2,950 feet from the shore, and covers an area of about 39,000 square feet. The water is 15 feet deep. The antiquities found here were meal-stones, corn-crushers, great stones for weights with iron rings, sling-stones, and pottery. This settlement is so far from shore that at one time it was thought probable that there might be a kind of pile-bridge connection with the opposite station of Nidau; but on further examination, this idea has been given up: it has not been proved.

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[1] See Dr. Ed. Freih. von Lacken's *Grabfeld von Hallstatt.* Wien. 1868. Will. Braumüller. Several *châtelaines* (as we now call them) somewhat similar, though not exactly so, are drawn on Plates XII., XIII., XIV., and XV.—[TR.]

Between Vingelz and Bienne is a raised elevation on the bed of the lake, covered with stones, but without any visible piles. Colonel Schwab got two iron javelins from this place. The bronze hook drawn Plate XC. fig. 12, was found at the mouth of the Scheuss. The pin, Fig. 15, came also from the same locality, as also the ornament of iron, Plate XXXIX. fig. 9.

LAKE OF NEUCHÂTEL.

The banks of this lake, like those of the lake of Bienne, were studded with settlements, the eastern side, more especially, offering many favourable localities from the gradual deepening of the water and the broad shallow margin (weisser Grund, blanc fond). It will be seen from the notices of the various settlements, and of the objects found in them, that some date from the earliest age, that others continued during the Helvetian times, and that not a few were inhabited even after the Roman occupation during the Gallo-Roman period of Helvetia. It remains yet to be proved whether any lasted to a still later age, though the present evidence seems to point to the contrary.

For the following notices as to the settlements on this lake, and the antiquities found in them, I am indebted almost entirely to the late Colonel Frederick Schwab of Bienne, who has rendered very great service to archæology by his zealous and careful investigation of these singular settlements. It is chiefly from his information that the maps of the lakes of Neuchâtel, Bienne, and Morat on Plate CV. have been drawn. It need hardly be mentioned that in the plan of the Neuchâtel lake the letters S B I and R mean the same as in the plan of the lake of Bienne. As the settlements in the lake of Neuchâtel are so numerous, and there are not always places in proximity from which they might be named, Colonel Schwab has numbered these stations from one to fifty. The present map is simply a reproduction of his former one, with the addition of a few lake dwellings lately discovered.

1 and 2. À LA TÈNE, PRÉ FARGIER, AND MARIN.—These settlements, though given under two numbers, are one and the same lake dwelling; a full account of the place and its antiquities will be found on page 406, and in order to prevent confusion it has been called Marin.

3. **Hauterive.**—There is here a large settlement extending over about 117,000 square feet; the water is from 4 to 6 feet deep. Two iron spear-heads and some pottery were found here by the late Colonel Schwab. This station has subsequently been investigated by Professor Desor, who has discovered a 'Steinberg,' or artificial elevation, very similar to that of Auvernier. No metal implement has been found on either 'Steinberg,' only bone and flint weapons; but pottery has been met with on that of Hauterive. The depth of water on the 'Steinberg' at Hauterive is greater than on that of Auvernier.

4 and 5. **Monruz.**

6. **Crêt.**—A small settlement. An implement was found here like a cylindrical roller, with an iron hook at each end. It weighed about a quarter of a hundredweight, and the letters I R were engraved upon it; several stone chisels were also met with here, and a great stone with a large cavity.

7, 8, 9. **Auvernier.**—See page 235.

10 and 11. **Colombier.**—In one of these settlements no actual piles are visible, but there is a subaqueous elevation, made of stones, chiefly broken; a quantity of burnt wood, however, has been noticed, and flint knives have been found here. The other settlement stands near the shore, and exhibits low piles. Flint implements, celts made of serpentine, and Roman tiles have been found here.

The following specimens have been found here of late years: Plate LI. fig. 1, ornamented bronze knife, fig. 6, socketed bronze knife.

12. A settlement about 70 feet from land. Depth of water, 16 feet. Roman pottery and tiles were found here.

13, 14, 15. **Cortaillod.**—See page 230.

16, 17, 18. **Bevaix.**—One of these settlements is near the Abbey and another near the mill. The late Colonel Schwab procured from these localities bronze hairpins, pottery, bones, and the handsome bronze knife drawn Plate XCIV. fig. 6. The station most to the south is about 90 feet from the land, and extends over an area of 97,000 square feet. Depth of water 15 feet; it appears to be richer in antiquities than the other two.

Two specimens have within the last few years been found here; they are drawn in the following plates: Plate LXI. fig. 1, a bronze pin with the head flattened; Plate LXVII. fig. 1, a bronze armilla.

19. **Chez les Moines.**—A settlement about 100 feet from

land. Depth of water, 4 feet. The area is about 77,000 square feet, with a raised portion called the 'Ténevière.' The antiquities found here consist of pieces of stag's horn, stone chisels, and fragments of Roman tiles. Grass grows on this locality.

20. Near St. AUBIN.—The extent of this lake dwelling is about 106,000 square feet. The piles extend to the shore. On the lake side the depth of water is about 5 feet. A quantity of pottery was found here, stone plummets or weights, bones, and pieces of stag's horn. Dr. Clément, a zealous and intelligent antiquary, has carefully examined this locality, and obtained from it a most splendid collection of very fine implements of stone, bone, and horn. Celts, knives, and daggers are found in great abundance, of all kinds of stone, and of every possible form. The tools and handles of horn, and the bone implements, are very numerous, and in capital preservation. No objects of wood were met with and but little pottery.

It is a very extensive settlement of the pure stone age, and has a 'Steinberg,' or 'ténevière,' from 200 to 300 feet under water, the south-west side of which is rather muddy. Piles are seen all over it, but more especially on the north side. The average depth of the water is from 8 to 9 feet; but the relic-bed can only be reached by digging 3½ feet under the present bed of the lake.

A number of flint arrow-heads found here are of great interest, as they may throw some light on the duration of the settlement. It appears that after having been brought into form they had been damaged by use, and then a second time worked up and sharpened. The parts of the flint which belonged to the original manufacture had become white by age, while those portions which indicate the second operation are 'honey yellow,' or the natural colour of the stone. This difference in the appearance of the surface, clearly indicates that an interval of many centuries must have elapsed between the first manufacture and the second operation of sharpening. In one specimen, thus showing marks of double working, there are upon it some remains of the asphalt, with which it had been fastened to the shaft.

Amongst the ornaments from this station are perforated fossil *Terebratulæ*, and also a few *Belemnites*, around which a groove has been cut for the attachment of a string. There are also perforated vertebræ of fishes, both fossil and recent.

Two flint saws, set in handles of yew wood, and in beautiful preservation, are drawn Plate LXXXIII. figs. 1 and 8, and a number of other specimens have been procured here, several of which have been drawn in the following plates:—

Plate XLII. fig. 4. Flint saw in a stag's horn handle.
„ „ „ 8. Bone pointer, in do. do.
„ „ „ 9. Ornament for suspension.
„ „ „ 11. Hafting of stag's horn.
Plate XLIII. fig. 12. Arrow-head.
„ „ „ 14. Double hook.
Plate XLIV. fig. 1. Stone celt, in stag's horn hafting.
„ „ „ 3. Bone hook.
„ „ „ 5. Stone celt, in stag's horn hafting.
„ „ „ 7. Ornament of bone.
„ „ „ 8. Bone scraper.
„ „ „ 9. Arrow-head.
„ „ „ 10. Bone tool.
„ „ „ 11. Bone chisel.
„ „ „ 13. Stone chisel in bone handle.
„ „ „ 14. Ornament for suspension.
„ „ „ 15. Bead of glass.
„ „ „ 16. „ amber.
„ „ „ 17. „ stag's horn.
„ „ „ 18.
„ „ „ 19. } Perforated bones.
„ „ „ 20.
„ „ „ 22. Bone pointer.
„ „ „ 23. Amber bead.
Plate XLV. fig. 1. Bone handle.
„ „ „ 4. Stag's horn implement hollowed out.
„ „ „ 5. Lance-head of bone.
„ „ „ 6. Pointer of stag's horn.
„ „ „ 7. Goblet of stag's horn.
„ „ „ 8. Bone pointer.
„ „ „ 11. Bear's tooth perforated.
„ „ „ 13. } Wolves' teeth perforated.
„ „ „ 14.
„ „ „ 15. Ornament of stag's horn, perforated for suspension.
Plate LVIII. fig. 19. Gold rosette.
„ „ „ 20. Gold ornament.
„ „ „ 21. do.
Plate LXXXIX. fig. 1. Flint arrow-head, fastened to the shaft with asphalt.

21 to 29 are fully described in the report given by M. Louis Rochat, on the lake dwellings in the neighbourhood of Yverdon. They comprise the well-known names of Concise, Corcelettes, and Les Uttins. M. Rochat's report will be found from page 266 to page 279. Perhaps it may be well to mention that No. 23 was reported by the late Colonel Schwab to be about 126,000 square feet in extent, and that here also the piles extend to the land; those which are the farthest in the lake stand in water 10 feet deep.

30. YVONAND.—A 'Berg,' or subaqueous hillock, without piles, and deeply covered with mud.

31.

32. FONT.—One of the most remarkable antiquities found here is the cupped or hollowed stone drawn Plate XXXIX. fig. 12. It is well known that stones with this peculiarity are met with in nearly all the countries formerly inhabited by the Celts. They have been found in the lake of Neuchâtel at Corcelettes, at Font, above Estavayer, and at the lake dwelling of Cortaillod, just opposite the shore, almost always in places which are dry at low water.

The implements met with in the neighbourhood of these hollow stones belong in general to the bronze age. The cups vary from 3 to 10 inches in diameter; they are seldom more than an inch in depth. They are made on the surface of the stone without any kind of order, except that when they are three in number they form, as it were, the points of an equilateral triangle, as may be seen in the drawing. The number of hollows or cups varies exceedingly; sometimes, as in the stones found in the lake dwellings above mentioned, there is only one, but more frequently there are from ten to twenty. A stone in the collection of Colonel Schwab, weighing about five hundredweight, is remarkable for having on one side a single hollow a foot in diameter, and on the other eight smaller hollows. These stones do not show the least trace of work except the cups; they are all made out of erratic blocks, and chiefly of granite, or some other very hard stone.

In the neighbourhood of Bienne, 'im Luterholz' on an exposed eminence, there is a block weighing about twenty hundredweight with eighteen hollows, of which eight are set in pairs, and six in rows of three joined together by furrows. A sketch of this stone was kindly communicated by the late Colonel Schwab, and is drawn Plate XXXIX. fig. 14. Another of these stones with hollows, drawn Fig. 13, was found in a grave opened on the height of Jolimont, between the lakes of Bienne and Neuchâtel; it is now in the collection of the late Colonel Schwab.

33 and 34. ESTAVAYER.—See page 254.

35. Below CORBIÈRE.—Distant from the land about 700 feet. Depth of water 8 or 9 feet. Extent about 58,000 square feet. A Roman water-jug was found here. The rocky shore, in which there are many hollows formed by the action of the water, bears the name of La Creuse, or 'Port des Sarrasins.'

36 and 37. FOREL.—Distant from the land about 880 feet. Depth of water from 5 to 7 feet. This settlement is of later date. Roman tiles have been found here.

38 and 39. CHEVROUX.—Distant from the land about 400 feet. Depth of water from 3 to 4 feet. One of these settlements nearest the village is covered with sand, and has been built over by a harbour mole. The other may possibly form part of the same dwelling. Spindle-whorls of stone have been found here, and also the singular bronze dagger drawn Plate XXXIX. fig. 1. A remarkable bronze implement is drawn Plate XXII. figs. 20, 21, 22, 23, and 24. The use of it is unknown. As it has a socket, it appears to have been fixed on a staff or stick; the four rings on the rod joining the two sides of the metal strip are movable.[1]

40. Above CHEVROUX.—Distant from the shore about 600 feet. Depth of water from 5 to 8 feet. Extent about 58,000 square feet. The antiquities found are pottery, corn-crushers, stone celts, bronze sickles, knives, swords, and armlets, and a great iron fork.

41. GLETTERENS.—Distant from the land about 600 feet. Size about 77,000 square feet. The depth of water from 7 to 8 feet. This settlement is of later date. Fragments of earthen vessels and of Roman tiles have been found here.

42.

43. PORT ALBAN.—About 980 feet distant from the shore in a depth of 5 feet of water. Extent 87,000 square feet. The antiquities found here were pottery, stone chisels, and pieces of stag's horn. Between this place and Cudrefin, according to Professor Desor, there is a station of the iron age.

44. About 590 feet from the shore. Depth of water 4 feet. Extent 68,000 square feet. Stone spindle-whorls, stone celts, pottery, and pieces of stag's horn have been found here.

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[1] A similar implement was found at Estavayer, and is described amongst the antiquities found at that place, page 262. See also Plate LXXI. fig. 5. Can it have been *blown into*, and so formed a rude kind of brass instrument and rattle at the same time?—[TR.]

45. Champ Martin.—About 400 feet distant from the shore. The water is about 4 or 5 feet deep. There is here a 'Berg,' or elevation of the lake-bottom. Probably this is an earlier settlement, but it has not yet been carefully examined; only clay spindle-whorls have been found at present.

46.

47. Near Cudrefin.—About 200 feet from land. The water is 2 feet deep. Extent about 77,000 square feet. There is a raised hillock to be seen here. The place is overgrown with weeds, and is partly dry when the water is low. The piles are numerous. Pottery has been found here, and a boat made out of a single stem. See the notice respecting the 'Einbaum' found here, page 282.

48.

49. À la Sauge.—This settlement, the extent of which has not yet been ascertained, is situated above 980 feet from the land. The depth of water is about 7 feet. The antiquities found here are pottery, among which is the specimen drawn Plate XXXIX. fig. 3, apparently a kind of funnel, Roman tiles, and the handle of a Roman amphora.

50. Pont de la Thièle (Zihlbrücke), between the two lakes.—This settlement is situated on the right bank of the river; it begins about 150 paces above the remains of a Roman bridge; it is continued under it, and terminates about twenty paces below. It touches the shore. The antiquities found here are stone celts in haftings of stag's horn, and also fragments of Roman pottery and tiles. The iron lance-head drawn Plate XCIV. fig. 7, was found about 3,000 feet above the Pont de la Thièle in the lake of Neuchâtel. In this locality piles are seen more than 3,000 feet from the shore. This lance-head is ornamented with raised lines and with furrows very similar to those on the iron fork from Möringen drawn Plate XL. fig. 3; the socket has on each side rather a sharp spike. Probably this weapon belongs to the series of iron implements, ornamented swords, &c., which have been found in the vicinity, and are described in this volume.

LAKE OF MORAT.

All the settlements discovered in this lake by the late Colonel Schwab are laid down in the map on Plate CV. Repeated excavations have also been made at many points by the late Colonel Schwab, Baron von Bonstetten, and the Count de Pourtalès, the owner of an estate on the west shore of this lake, and the result has been the acquisition of many interesting specimens, and of much valuable information. On the whole we may remark that some of the stations, such as that part of Greng which is nearest the shore, belong exclusively to the stone age, while others, such as Montellier, were founded in the stone age, but continued till the bronze and iron periods. With respect to the character of the objects found at the last-named station, it is striking that the earthenware vessels, although made with the hand alone, yet show a certain skill in the workmanship, a great variety, and much elegance of form, all of which qualities are wanting in the corresponding objects from the bronze settlements of the lakes of Eastern Switzerland, such as those of Sempach and Ueberlingen. It is a remarkable fact that in that part of our country where the chief place, Aventicum, was situated, we should find proofs in prehistoric times of a very early advance in civilisation. If we possessed no other proof of the early progress of this district, the bronze die for the largest type of Gallic gold coins found some years since at Avenches would place the correctness of this observation beyond a doubt. (See the 'Archæological Journal' for 1862, p. 253, and vol. xv. of the 'Transactions of the Zürich Association': Dr. Meyer's 'Gallic Coins,' p. 4.)

The settlements are on both sides of the lake, and are nearly at regular distances apart.

1 is a large station with numerous piles, about 930 feet from the shore. The piles project 2 or 3 feet from the lake-bottom.

2. MONTELLIER.—See page 291.

3. This settlement lies a little above the monument of the battle of Murten or Morat. It is about 1,080 feet from the land, and is of considerable extent. The piles are not visible.

4. Near GRENG.—See page 284.

5. A small settlement. Depth of the water from 4 to 6 feet.

6. A large settlement, but to the present time nothing has been found here but Roman tiles.

7 is like 6.

8. A small settlement in water 3 feet deep. No piles are visible.

9. A small station, apparently without piles; depth of the water 3 feet. Pottery is found here.

10. A small settlement. Between the stations 10 and 11 the late Colonel Schwab found about a hundred clay vessels, some perfect, and some broken to pieces; several of them were prettily formed, and neatly ornamented; he also found what are called slingstones, corn-crushers, clay rings, and, lastly, a bronze ear-

ring, and a bronze plate with traces of tinning like those found in the Gallo-Roman settlements, Plate XCVII. fig. 14.

11 is situated somewhat farther off in the lake. No piles are visible.

12. A small place; nothing has been found here as yet.

13. Rather a large settlement, but also without antiquities.

14. A small settlement. A stone celt, an iron javelin, and Roman tiles have been found here.

15 and 16. These places are covered with 15 feet of water.

When the investigations were carried on in this lake, the water unfortunately was very muddy, and in many places, as for instance at Nos. 10 and 11, where most of the pottery was found, the bottom was covered with lake grass. To examine it completely, it would be necessary to employ a mud-machine.

Baron von Bonstetten, who has investigated this lake, and confirmed the observations made by the late Colonel Schwab, has drawn attention particularly to the problematical use of the conical settlements found in it. They bear the greatest resemblance to the sepulchral tumuli on land, and according to Colonel Schwab's report, the summit would only afford room for the erection of a single house. Towards the landside they are only 2 or 3 feet higher than the lake-bottom, but towards the lake these little hills have a rapid slope of 16 or 18 feet; when the water is low, some of them project from the surface. They consist entirely of rubble and broken stones, and are quite circular at the base. The Baron von Bonstetten examined one of them carefully, and was unable to discover even a trace of piles, of pottery, or of anything formed artificially.

The stations which exhibit these artificial and conical elevations are Nos. 2, 3, 6, 8, 9, 10, 11, 12, and 14.

The richest place of the lake of Morat is near Guévaux (between 10 and 11); this is where the largest number of earthenware vessels are found, and where the late Colonel Schwab's dredger met with a piece of the clay lining of the huts resembling in height and curve a portion of a large pot. Here also was found the earthenware vessel drawn Plate XCVII. fig. 15; it has the neck perforated with a row of holes one above another, each in a line running round the neck. These perforated vessels, it will be remembered, have been repeatedly found in other settlements, both in the lakes and on the mainland.

A curious implement of bronze, drawn Plate LXXI. fig. 4, was found in La Broie. The use of it is unknown; it probably belonged to the lake-dwelling age.

LAKE OF GENEVA.

The settlements on this lake, both on the northern and southern shores, have been discovered and investigated by M. Troyon, Professor Morlot, some antiquaries of Geneva, and especially by M. Forel, of Morges, President of the Historical Society of Western (Romanischen) Switzerland. It is to the last-named gentleman that we are indebted for an accurate account of the lake dwelling of Morges, one of the most extensive of these settlements, and also one which has afforded the greatest number of antiquities. He has established a very instructive museum of the antiquities discovered in the lake; amongst which will be found many remarkable bronze implements, and a great number of earthenware vessels equalling the best specimens of the potter's art of these early ages.

The settlements of this lake extend to a considerable depth into the water, and exhibit a firmer and better preserved substructure than those of the eastern lakes, which were founded and came to an end in what is called the stone period. This peculiarity of the pile villages of the lake of Geneva, together with the nature of the antiquities found in them, lead M. Troyon to the conjecture that beneath the remains of dwellings bearing the character of the bronze age those of the earliest stone age may possibly lie buried. The piles of the colonies in the lake of Geneva consist chiefly of stems of oak from three to eight inches thick; they are placed at various distances from the shore, and had been driven into the muddy bottom, where the water is from eight to twenty feet deep; even at the present day some of them project above the bottom five or six feet. They are placed from one to two feet apart, and sometimes more, but they form no regular lines, though as a whole they exhibit a certain kind of arrangement parallel with the shore.

The following is a list of the settlements on this lake so far as they are known:—

1. Cully.
2. Lutry.
3. Pully.
4. Cour.

5. Vidy.

6. St. Sulpice.

7. Morges.—See page 295.

8. St. Prex.

9. Rolle.

10. Nyon.—Opposite the anchoring-ground between the harbour and the point of Promenthou. The earthenware vessel drawn Plate LXXXVIII. fig. 16 was found here.

11. Versoix.

12. Pâquis.

13. Rive.

14. Opposite Geneva.—The piles are to be found in different places at the end of what is called the 'little lake.' Rows of piles are seen running sometimes straight and sometimes diagonally across the lake, and are known by the name of 'Travers.'

Since the publication of the first edition, several antiquities have been found here, of which those drawn in the following plates are the most interesting:—

Plate LXXXVIII. Fig. 4. Bronze pin. The upper part made into a ring.
Fig. 5. Bronze pin.
Fig. 6. Ditto.
Fig. 7. Bronze pin, with a *double* head.
Fig. 8. Flattened ring of tin.
Fig. 12. Mould of 'molasse' for casting rings.
Fig. 17. Earthenware vessel.
Plate LXXXIX. Fig. 3. Bronze comb.
Fig. 4. Crescent of earthenware.
Fig. 5. Ditto.
Fig. 9. Bronze knife.
Fig. 11. Bronze armilla.
Fig. 12. Ornamented earthenware vessel.

Amongst the specimens drawn in the 7th Report are three earthenware vessels, in the collection of Dr. von Gross, Plate LXXXVIII. fig. 13, 14, and 15. Probably these vessels are from Geneva, as they are drawn on the same plate as many of the above.

15. La Belotte.

16. La Gabiule.

17. Bassy.

18. Hermance.—At a distance from this place along the

shore of Savoy, which may be accomplished by boat in about twenty-five minutes, there is the site of a lake-dwelling. It is easily recognised by the number of oak piles (red oak) fixed in the lake-bottom, as well as by the numerous fragments of pottery, which may be seen. Some beautiful bronze celts, sickles, and fibulæ have been dredged up here. See the 'Journal de Genève,' September 30, 1857.

19. **Beau Regard.**

20. **Nernier.**

21. **Yvoire.**

22. **Thonon.** The bronze knives drawn Plate LXXXVIII. figs. 2 and 11, were found here.

23. **Evian.**

24. **Amphion.**

LAKE OF LUISSEL, NEAR BEX.

The following notice of this place is taken from the account given by M. Troyon in the 'Anzeiger für Schweizerische Geschichte und Alterthumskunde,' 1858, No. 2. I do not hesitate to attribute to this kind of construction the 'find' which was made at the end of the last century in the little lake of Luissel, near Bex, where the beautiful lance-heads and three fine bronze swords were found, which are now preserved in the museums of Lausanne and Bern. An eye-witness of this discovery has assured me that in the same place pieces of wood, bones, and also some corn were found buried in the peat. An account of this discovery is to be found in the 'Nouvelliste Vaudois' of October 31, 1803. The date of the discovery was March 24, 1791, and it occurred in consequence of the works for draining and procuring the peat.

The two sword-handles of bronze drawn Plate LXXXVIII. figs. 9 and 10, are said to have been found in this lake. There seems to be a little doubt as to the latter, which is now in the museum at Bern.

LAKE OF ANNECY.

Two lake dwellings have been discovered in this lake.—See the 'Bulletin de l'Association Florimontane d'Annecy,' No. 5, p. 201, 1856.

LAKE OF BOURGET.—See page 331.

MERCURAGO and BORGO TICINO.—See page 348.

SAN MARTINO AND TORRE BAIRO.—See page 353.

LAKE VARÈSE.—See page 355.

PESCHIERA AND THE LAKE OF GARDA.—See page 362.

LAGO DI FIMON, NEAR VICENZA.—See page 367.

TERRA MARA.—See page 378.

GENERAL REMARKS ON THE LAKE DWELLINGS.

After having taken a view of most of the lake dwellings which have been discovered in the Swiss district up to the present time, we hope that a few words respecting the nature of these settlements, the date of their existence, and the nationality of their founders, will not be considered unsuitable even if the discussion should end in mere conjecture.

No one who was present during the excavation at Meilen, the earliest settlement examined, and who saw the number of household utensils, the beds of charcoal ashes, the hearthstones, the pottery, the remains of wild animals which had served for food, and especially the 'relic-bed,' partly arising from the accumulation of this animal refuse, and limited to this very locality, has ever denied that on this very spot where the piles and so many products of human industry were found, there had once been a regular settlement, and that however much it may be contrary to our preconceived ideas of the lazy life of a hunting and fishing people, the mass of piles formed the foundation of their dwellings.

But though there was no doubt as to this general fact, another question arose and created much interest amongst the workmen as well as the bystanders, namely, whether the primitive race had lived here on level ground, on the dry though perhaps sandy and loamy banks; or whether we might conclude that the piles stood, as they now do, in the lake itself, but originally projected above the water even at its highest level, and that the huts of the settlers had been built on the tops of these piles as on a kind of bridge.

After so many lake dwellings have been examined, it may possibly be thought needless to enter into this question, as it is virtually set at rest. Still, as the first alternative has been brought forward, and it is possible that some persons may still adhere to it, there can be no harm in devoting a few lines to a consideration of it.

In the first place, it involves the somewhat venturesome, but often repeated, hypothesis that in early times the surface of the lake of Zürich and that of most other Swiss lakes was lower than at present. In order to gain a foundation for this assertion, it is pointed out with reference to the Zürich lake that ever since the foundation of the city, till comparatively a late period, whatever earth was dug out for building purposes or for levelling the ground was at once thrown into the river, as well as all rubbish and sweepings, just as was the case in all the cities situated at the outlet of lakes. This, together with the encroachments of buildings and streets, had seriously altered the original width of the river-bed. As a direct proof that there has been a gradual elevation of the bed of the river, the fact is brought forward that when excavations are made a few feet deep in the bed of the Limmat, pottery, bones, implements of metal, and other remains of the early ages are met with.

If, therefore, the lake having its outlet thus reduced was dammed or penned up in later times, and its surface a few thousand years ago was lower than at present, the settlers at Meilen, and similar erections, in driving such an immense number of piles would have intended nothing more than to secure a strip of land on the banks of the lake from any damage which might be caused by the waves, so that they might erect their abodes on the dry mainland, and apply themselves to all the business of life in perfect safety.

According to the second view, with which, after having examined the piles in the lake of Bienne, and for many other reasons, we agree most entirely, the piles were from the commencement driven into the actual bed of the lake; and they were so long that their heads stood a few feet above the water, whatever might be its level.[1] They stood in close rows, and when covered with horizontal timbers and boards formed a scaffolding, making a firm foundation for the erection of the dwellings. These abodes were therefore like the fishermen's huts which were found in earlier times, and perhaps even now are to be seen on several of the Swiss lakes. We know, indeed, very little as to the shape of these ancient huts, except that they were built of poles and hurdlework, coated on the outside with clay, just as was the case at Ebersberg on the mainland, described towards the close of this volume. In or near the huts there was room enough for all the operations of daily life to be carried on, as well as the manufacture of every implement used in household economy. Here they cooked, and here they spun; here clothes, string, and all manner of hunting and fishing tackle were made; here serpentine, stag's horn, and bones of various animals were worked up into tools; here the pottery was manufactured. In short, this was the place where every craft or art known to the settlers was brought into play. All the refuse of burnt wood, the remains of animals used for food, and useless or broken utensils were thrown into the water, where they sank in the mud.

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[1] The difference between the highest and lowest level amounts to full eight feet.

Probably the first idea of erecting this kind of pile building may have arisen chiefly from the necessity of securing the lives and property of the colonists from the irruption of enemies.[1] The same reasons which led men in one place to settle on inaccessible heights, and to surround themselves with walls, induced a part of the earliest inhabitants of Switzerland to found dwellings in the lakes. On this account these strongholds were placed at some little distance from the land, and could with ease be defended against an enemy, who would have to advance either in boats or over a bridge. These lake dwellings cannot possibly be considered merely as places of refuge to be used in time of need, on account of the number of household utensils found in them, and also from the existence of the 'relic-bed,' which seems to indicate that these settlements lasted, and were actually inhabited, for a long period. Besides this, it is very evident that this particular kind of erection offered many advantages for both fishing and navigation.

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[1] In the original report, printed some years ago, I stated my belief that the colonists in erecting pile-buildings in the lakes, wished to secure themselves from the irruption of enemies, and the attacks of wild beasts. A closer consideration of the subject has led me to modify my opinion. In an account of the lake dwellings by Professor von Hochstetter, printed in No. 51 of the 'Oestr. Zeitsch. f. Wissenschaft,' &c. p. 1613, the following paragraph occurs: 'This people must have had their chief settlements on land, and the lake dwellings must have been used for some special purpose. It does not appear to me that safety from wild beasts had anything to do with their erection; wild beasts avoid the human race, and even uncivilised man is nowhere in the world so helpless as to fly to the water for protection from ravenous animals.' Though I consider the first part of this assertion inadmissible, which refers to the actual use of these settlements, yet the view of this well-known naturalist, who had the opportunity of studying for a length of time the manners and customs of living races under exactly similar conditions, is worthy of all attention, and I have consequently again examined the grounds of the opinion I expressed with reference to security from wild beasts.

When we speak of ravenous beasts in the Alpine regions, we can only refer to bears, lynxes, and wolves; for no mention is made in history of any others, and these are the only animals of the kind whose remains are found either in the lake dwellings or buried in the soil. Now, I have searched in vain in the oldest written chronicles of our country for any instance in which a man has been seized by one of either of the two first-named animals; and with respect to the third, Conrad Gessner expressly declares that the wolf, so long as his usual sustenance does not fail him, will not venture to attack men; and Stumpf, who wrote in the middle of the sixteenth century, says that fewer wolves are found in the Alpine Mountains and Helvetia than in any other country of Europe, for if they came, as was probably the case, from Lombardy or the German countries, they would not be of frequent occurrence.

From this it appears that the idea must be abandoned which supposes that the lake dwellings were erected as a protection against wild animals.

With respect to the age of the *early* settlements of this nature we have not a single safe datum to guide our determination, so that it is quite impossible, with any probability, to decide even approximately the century or the centuries when they existed. The banks of lakes and river-valleys seem to have been the spots preferred by men in the early ages for permanent settlement, at first probably to support themselves by fishing and hunting, afterwards for their convenience as shepherds and tillers of the ground, and in still later times on account of the greater facility of intercourse.

But though we are unable to decide the age or ages when settlements such as Meilen existed, yet there can be no possible doubt that, from the antiquities found there—even granting some degree of uncertainty as to the flint and stone implements (for they lasted in some cases through several periods)—we are obliged to ascribe to them a very high antiquity.[1] We may venture to place them in an age when iron and bronze had been long known but had not come *into our districts* in such plenty as to be used for the common purposes of household life, at a time when amber had already taken its place as an ornament and had become an object of traffic. The fact that in the settlement at Meilen there were few bronze and no iron implements, while bronze is abundant, and iron not rare, in the settlements of the Bienne lake, may possibly be explained by the seclusion and poverty of the colonists at Meilen, who lay beyond the reach of barter, and possessed no materials for carrying on this trade. Very probably the same relations existed here as at the present day in Western North America and several other countries whose inhabitants can by barter obtain the necessary instruments of metal, but yet are compelled to employ for their common household purposes those materials which are afforded to them in such abundance by the animal, vegetable, and mineral kingdoms.

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[1] The settlement at Meilen appears to belong to about the same period as the tumuli or barrows of South Dorsetshire, described in the Archæologia, vol. xxx. p. 327. 'The articles found in these barrows comprise urns of varied size and form, of coarse material and rude manipulation, implements of bone, beads of clay, flint arrow-heads, deer's antlers, and, but rarely, weapons and implements of bronze.' Also some tumuli in Wiltshire (Archæol. xv. 122, and Sir Richard Hoare's account) in which similar objects were found to those at Meilen, and the tumulus described by Ledebur at Malitschkendorf, in the province of Saxony (das Königl. Museum vaterländ. Alterth. im Schlosse Monbijou zu Berlin, 1838), in which, amongst other things, were found a number of boar's tusks, stag's horns, bones of domestic animals, besides pottery, a spindle-whorl, battle-axes, mealing-stones, weights for nets; and further, awls, needles, styles, and arrow-heads, the whole of which were made out of the horns and bones of the stag.

As a similar state of civilisation always calls for similar wants, and these again for similar means to supply them, and consequently similar utensils for the different purposes of life, we shall be able to gain the clearest idea of the civilisation of the colony of Meilen and other settlements of a like age, if we compare the products of their industry, and the ideas we have consequently formed of their culture, with the accounts given by those travellers who in the last and present century have visited nations beyond the reach of European civilisation, and who spent their existence under similar conditions of life. The picture we have given of the settlers of these early colonies from the antiquities found in their ruins, resembles in a striking manner that which Captain Cook gives us of the inhabitants of New Zealand, which he visited in the year 1770. We venture on giving the following extract from his work:—

'Having said thus much of the workmanship of the New Zealanders I shall now give some account of their tools. They have adzes, axes, and chisels, which serve them also as augers for the boring of holes. As they have no metal, their adzes and axes are made of a hard black stone, or of a green talc,[1] which is not only hard but tough, and their chisels of human bones or small fragments of jasper which they chip off from a block in sharp angular pieces like a gun-flint. Their axes they value above all that they possess, and never would part with one of them, for anything that we could give. I once offered one of the best axes I had in the ship, besides a number of other things, for one of them, but the owner would not sell it, from which I conclude that good ones are scarce amongst them. Their small tools of jasper, which are used for finishing their nicest work, they use till they are blunt, and then, as they have no means of sharpening them, throw them away. We had given the people at Tolaga a piece of glass, and in a short time they found means to drill a hole through it, in order to hang it round the neck as an ornament by a thread, and we imagine the tool must have been a piece of this jasper. How they bring their large tools first to an edge, and sharpen the weapon which they call Patoo-Patoo, we could not certainly learn, but probably it is by bruising the same substance to powder, and with this grinding two pieces against each other.' ('Hawkesworth's Voyages,' vol. iii. p. 395.)

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[1] Called *Talcum nephriticum* by Linnæus, 1768.—'Nephrite' or 'Jade' of Miner.—[Tr.]

To this extract we may add a few more particulars taken from the same work. The New Zealanders make all kinds of twine fishing-tackle and cord out of the leaves and fibres of the New Zealand flag, a vegetable which grows there in abundance, and serves them instead of flax. They wear on cords all kinds of ornaments, such as chisels and awls, or 'bodkins made of green talc, upon which they set a high value, the nails and teeth of their deceased relations, the teeth of dogs, and everything else that they can get which they think either curious or valuable. The women also wear bracelets and anklets made of the bones of birds, shells, or any other substances which they can perforate and string upon a thread. They carry on weaving and other peaceful arts. Their houses are the most inartificially made of anything among them; they are seldom more than 18 or 20 feet long, 8 or 10 broad, and 5 or 6 high, from the pole that runs from one end to the other, and forms the ridge, to the ground; their framing is of wood, generally slender sticks, and both walls and roof consist of dry grass and hay, which it must be confessed is very tightly put together, and some are also lined with the bark of trees, so that in cold weather they must afford a very comfortable retreat. The roof is sloping like those of our barns, and the door is at one end, just high enough to admit a man creeping upon his hands and knees; near the door is a square hole which serves the double purpose of window and chimney, for the fireplace is at that end nearly in the middle between the two sides. That part of the floor which is allotted for the fireplace is enclosed in a hollow square by partitions either of wood or stone, and in the middle of it the fire is kindled.'

'Their household implements and tools are few in number; their largest boats consist of boards bound together; the smaller ones are merely one trunk hollowed out by fire. Their fishing-hooks are made either out of bone or shells. They have spears and javelins, some of which are pointed with bone, but they chiefly rely on the Patoo-Patoo, which is a kind of club made either of green talc or some very large bone, shaped somewhat like a pointed battledore, with a short handle and sharp edges, admirably fitted for close fighting, and such as would certainly split the thickest skull at a single blow; the handle has a hole bored through it, and they wear it fastened to the wrist with a strong thong.[1] Their agriculture is very simple; the ground is merely turned up very carefully by a sharpened stake, with a short cross piece attached, for the convenience of pressing it down by the foot.'

Let us now endeavour, by comparing the facts which have come before us when investigating the remains of the lake dwellings, to draw a picture of the manner of life and industrial activity of these very ancient inhabitants of Switzerland and the neighbouring districts.

But before doing so, it may be well to state what was not known when the first edition was published, that the custom of erecting pile dwellings in lakes extended over a wide tract of country. The notices in the present volume will convince any one who reads it of this fact. Similar remains are found nearly in every suitable lake from that of Bourget on the east to Asia Minor on the west. In order to show at a glance how general the custom was, a map on a large scale has been drawn taking in most of the countries where lake dwellings are found, and to make the settlements more distinct they have been coloured red. Of course it is impossible in a map like this to put down every lake dwelling, but it will at all events give a general idea of their frequency. The 'terramara' beds are not included. The map will be found on Plate CCVI.

The settlers appear to have considered a sunny shore, in some measure protected by hills and promontories from storms and the action of the waves, as a peculiarly favourable locality for erections of this nature. A pleasant bay, opening to the south, at the foot of well wooded hills abounding in game, must have been thought particularly inviting. But as even the earliest settlers were not only fishermen and hunters but also shepherds and agriculturists, as may be proved by the remains of domestic animals and the stores of grain found in the ruins of their dwellings, we may conclude that the neighbourhood of good pastures and tillage land materially influenced them in choosing the sites for their habitations. A second indispensable requisite was a lake shore tolerably broad but not very deep, chiefly composed of what is called in Switzerland 'weissgrund,' 'blancfond,' and in English shell-marl, so that piles driven into the lake-bottom might project a few feet above the surface of the water even at its highest level. The ground must necessarily have been of a muddy or gravelly nature, for piles could not have been driven in where the locality was rocky. According to the slope of the shore and the extent of the shell-marl, the lake dwelling was placed farther from or nearer to the land, frequently however so close to it that access might be obtained by a bridge or stage from two to three fathoms long. The piles which were used for the substructure of these dwellings were straight stems, from 4 to 8 inches thick, of the kinds of wood growing in the neighbouring forests, viz. oak, beech, fir, pine, and birch. The trees having been felled either by means of fire, or with the stone hatchet, were used either whole or split, some with the bark on, some peeled; and in order to facilitate the driving they were sharpened at the lower end either by fire or by the stone axe above referred to. The pile-driving, which necessitated the use of a raft, was effected by means of heavy stones and ponderous mallets, many of which have been found. There can be no doubt that the piles were placed, not at random, but according to a regularly arranged plan, and as there is hardly a case in which the superstructure of any of these dwellings yet remains, so in like manner the original arrangement of the piles can very seldom be made out. They appear above the lake-bottom like the remains of a forest snapped off by a storm or destroyed by an avalanche. When the piling was finished, which of course was of greater or less extent according to the number of the colonists, the outermost piles, at least in some cases, either to prevent the splashing of the water under the future abodes, or for the sake of catching fish, were securely wattled together with twigs. Then came the equally difficult and laborious task of making the platform on which the huts were to stand, and which had also to be large enough to carry on many different operations. To accomplish this, stems or trunks 10 or 12 feet long had holes bored in them at both ends, and they were then fastened with wooden pins to the heads of the upright piles which had been previously brought to a level. Trunks of fir-wood 5 or 6 feet long were then split into boards about 2 inches thick, and fastened with wooden pegs into the framework, and thus formed a solid, even platform.

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[1] This remark explains the occurrence of holes in the handles of many kinds of bronze weapons in the lake dwellings.

The great number of objects lying scattered on the bed of the lake, which had slipped through the chinks, shows how imperfectly the boards and planks fitted together, over the piles. Again, the quantity of broken stone celts, broken pottery, and refuse of animal and vegetable food lying together show that there were spaces intentionally left in the platform. With respect to the shape and condition of the huts, we can hardly give any positive idea, as in most cases these parts of the dwellings have been destroyed by fire. So far is certain, that the walls consisted of upright poles, wattled with rods or twigs; and in order to keep off the wind and the rain, this wattlework was covered both inside and outside with a bed of clay from 2 to 3 inches thick. There can be no doubt that the huts of several kindred races on the mainland were in many cases circular;[1] but all the evidence we possess as yet, respecting the huts of the lake dwellings in Switzerland, tends to show that they were rectangular. The curve of the small pieces of clay covering of the wattlework found at the bottom of the water cannot be brought forward to prove that the huts were circular, still less to show their diameter; these pieces are generally not more than 1 foot wide, and have evidently been exposed to great heat before they fell into the water; besides which, slabs with very different curves and some even perfectly flat were found promiscuously on the same spot. Clay was also spread out on the floor inside the huts, in some cases mixed with gravel, forming a kind of plaster floor and filling up the chinks. In the middle of the hut was a hearth made of slabs of rough sandstone. The roof consisted doubtless of the bark of trees, straw, and rushes, the remains of which have in many cases been preserved in the mud. It is impossible to ascertain whether the platform was covered densely or sparingly with huts, though we know that in one case, at Niederwyl, they stood very close together. We have only lately ascertained that the cattle, as appears to have been the case with the Pæonians, by the accounts of Herodotus, were brought here for shelter and regularly stalled in these lake dwellings.

The occupations of the settlers were of many various kinds, and may be divided, according to the different modes of procuring sustenance, into the operations of fishing and hunting, pasturage and agriculture.

The large number of skeletons of fish which had been used for food, and especially the skulls of very large pike which are found buried amongst the piles, are a proof that fishing was carried on very successfully. In some of the earliest settlements the actual fishing-nets and hooks made of boars' tusks have been found. And if we look at the implements used for taking fish by the uncivilised races of North America and the South Sea Islanders, we may venture to assume that the lake-dwellers also relied on darts and javelins for catching the fish which abound in the Swiss lakes. Some of the points made out of bones of birds and small animals, frequently barbed, remind us forcibly of the fishing implements of these nations.[1]

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[1] Strabo, iv. 4.—The Belgian Gauls make their huts spacious, out of boards and willow hurdlework, dome-shaped with a high roof.

The chase of game in the forests was no less productive. If we read the accounts given in ancient writings[2] of the great quantity of game of all sorts, and the number of rapacious beasts such as bears, lynxes, and wolves which lived in the forests and deep mountain valleys, we can form some idea of the abundance of animals of the chase which ranged over the land when the country was still covered with the primeval forest, and the scattered population was still unprovided with adequate weapons of the chase. The bones which lie about in the lake dwellings in astonishing numbers, of stags, roes, wild-boars, beavers, otters, squirrels, and other animals, are an evidence of the abundance of game, and of the ability of the settlers to bring down even the higher descriptions of wild animals. There are many proofs also that the urus and also beasts of prey, such as the bear and the wolf, were not safe from their clubs and javelins. At all events the products of the chase formed no inconsiderable portion of their subsistence.[3]

It has been well observed by Professor Rütimeyer that 'the lake dweller lived in a certain manner like an islander in the middle of a rich world of animals at enmity with him. If the domestic cattle and hunting provided him with meat, yet there was no superfluity, for it is a general peculiarity of the refuse of their kitchens that all the bones which contained marrow, or anything eatable, had been carefully hunted over for this miserable pittance. All the bones with marrow, and especially the long bones of the extremities, have been opened lengthwise, and in the skulls where the inner pulp of the teeth and the surrounding cellular tissue may be looked for in the jaws, these parts, without exception, have been opened with a readiness which by constant use had almost become art.'

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[1] According to Diodorus Siculus, iii. 15, the Ichthyophagi, amongst the Ethiopians, catch fishes and seals without any artificial weapons; they merely strike them with bucks' horns. Everywhere, he says, necessity teaches man to find out the means of attaining what he most requires in his own condition of life.

[2] See Benedictiones ad mensas, in vol. iii. of our Transactions, translated into English by W. M. Wylie, Esq., M.A., F.S.A., and published in the Journal of the Archæol. Institute for 1865. Also the old chronicle 'Gessner's Thierbuch,' &c.

[3] Perhaps the aurochs, the urus, and other wild animals, were taken in the manner now made use of in America, where deep pits are excavated and covered with branches of trees. The animals which had fallen into one of these pits, and which the colonists with their imperfect weapons would otherwise be unable to overpower, might now be despatched with stones; we have no doubt that some of what are called 'Mardellen or 'Kesselgruben' (see vol. vii. No. 7 of our Transactions) may be considered as pits for catching wild animals.

One circumstance of the highest interest in studying the grade of civilisation possessed by the lake dwellers, is that they were not ignorant of the art of keeping cattle, and consequently had already made the first steps towards civilised life. In fact, the possibility of so many people living together as could be lodged in a settlement of the size of those of Wangen or Robenhausen can only be explained by the population depending, not solely on the chance produce of hunting and fishing, but also on cow-keeping, which would provide the necessary subsistence at all times of the year. The investigation of the bones which are found in such great numbers amongst the piles of all the lake dwellings has shown, that together with the remains of the beasts of the chase, those of the domestic animals are met with, especially of the dog, which even in the oldest settlements is found as man's companion, and moreover of cows, sheep, goats, and pigs. This fact changes the ideas which on a superficial view of these abodes, constructed so strangely and with such primitive mechanical means, we may have formed of the condition of their builders, and obliges us to place their grade of civilisation much higher. The attendance upon cattle presupposes the knowledge of many arrangements — a regulated continuous activity, and a care for the future, qualities which are not to be found in the mere hunter.

This multifarious activity rendered necessary a division of labour; for the individuals who looked after the cattle, led them to pasturage, protected them from the attacks of wild beasts, and stored up dried grass and winter food for the different kinds of animals, could not possibly occupy themselves also with the chase or the manufacture of tools. The domestic economy, therefore, of those colonists, whom we know to have been also shepherds, may be considered in a more favourable light, and shows that their condition must have been far more tolerable than at first sight one would have imagined.

Besides this, in every lake dwelling are to be found stones for bruising and grinding grain, or what are called corn-crushers and mealing-stones; the very grain itself has been found at Meilen, Moosseedorf, and Wangen, nay, even the very loaves or cakes in their original form; and we therefore recognise the colonists as agriculturists, and see them advanced to a grade of civilisation when men formed permanent abodes, and secured for themselves a peaceful neighbourhood and social order. The tilling of the ground must indeed have been simple in the highest degree, and have consisted merely in tearing it up by means of inefficient tools made of stags' horns (see Plate CXXXIX. fig. 3) or with crooked branches of trees, as is now done in North America. But the products obtained by this imperfect tillage from ground which would further have to be enclosed by hedges as a protection against wild animals, are of a quality which is not surpassed by the produce of the present day.

As Professor Heer has favoured us with some remarks on the husbandry of the inhabitants of the lake dwellings, which will be printed hereafter, it will only be necessary here to give a few more particulars as to the kinds of corn hitherto discovered: they are wheat, and the barley with two rowed ears, which at the present day is cultivated in the East. Barley and wheat are, in fact, those cereals which are well known to have been cultivated in the east of Europe, whence the original immigration of the human race came westward. Herodotus (iv. 17, 18, 33, 53) expressly states that the culture of wheat was carried on in the southern part of Scythia, and that corn was an article of trade with the population of that district.

The settlers also cultivated flax of excellent quality, the care and preparation of which required great attention and skill of various kinds; it was spun into threads by means of spindle-whorls, and platted or woven into mats and coverings. The early use of the loom in the countries just mentioned is affirmed by Herodotus (book ii. 105, iv. 74). As the industrial arts connected with flax and other vegetable fibre, as well as the preparation of the skins of beasts, are of considerable importance, a special chapter is devoted to them in a subsequent part of this volume.

A great deal of time would probably be occupied by the manufacture of implements for domestic purposes, for the chase, and for fishing, as well as of the tools required to make them. As we have already remarked that the multifarious activity in these colonies may have required a division of labour, this idea is forced upon us anew if we examine the great variety of tools used by the settlers. In illustration of such a division of society, the following extract from Schoolcraft on the primeval inhabitants of Florida and North America may be of interest.

It is taken from his work 'History, Condition, and Prospects of the Indian Tribes of the United States,' iii. 75. He says: 'It is very clear that the art of the potter with these races was a "fixed art," and the occupation of a particular class of this people. A hunter or a warrior could not lay aside his bow or his club and set to work to make pottery. The art of mixing clay with gravel,[1] so that the vessel does not change its form in the furnace, and bears a sudden transition from heat to cold, and *vice versâ*, presupposes, when successfully carried on, uncommon practice and long experience. Much less could the general population manufacture flint implements of really good quality. Splitting the flints and making the fragments into the shape of lance- and arrow-heads, knives, and saws, requires extraordinary ability and long practice. Amongst the primeval inhabitants of North America there was a peculiar class of people whose business it was to select the suitable stones, and to manufacture arrow-heads, and who received from the hunters flesh and skins in payment for the implements supplied to them.'

As at the present day steel is the material to which either directly or indirectly nearly every implement owes its form, so, if we take a view of the manufacturing arrangements of the lake colonists, we shall be convinced that flint was the substance by which nearly all their instruments, whether of stone, wood, or bone, took the required form. By means of flints the stone hatchets or celts were worked out of the rough, and the bones sawn into piercers and arrow-heads, and thus it was the means of originating the tools required for the erection of dwellings and weapons of the chase. As metals were entirely wanting, unless flint had been procurable, we can hardly imagine the erection of the lake settlements, or even the very existence of men in the Swiss districts. And yet it was by no means the most abundant of those stones which were used for handicraft tools, and it was never worked in Switzerland to such an extent as in Denmark, England, and France. The reason is simply this: flint is found but sparingly in Switzerland, in the range of the Jura, and it occurs also in small masses, not fit, even if the workmen had the required skill, to make the larger tools, or any of the implements and weapons which occur in the North, and are so justly admired. Instead of flint, other hard stones were used which were found in plenty, and answered the purpose not only of splitting but also of sawing and grinding down, so that more patience was required than skill.

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[1] The clay vessels of these people agree in a remarkable manner and most completely with those found in the lake dwellings so far as the material is concerned.

Amongst the stone implements the celts and chisels were by far the most abundant amongst the lake dwellings, and were used for many various purposes. They were manufactured in the following manner: in the first place a selection was made from the rolled or rubble stones abounding in the Swiss valleys; those being chosen which were hard and also tough. There is such an infinite variety amongst these stones, that it is difficult even for an advanced geologist to make out with certainty their original locality and nature. The celts found at the lake of Bienne, at Bern, at Zürich, and at the lake of Constance, form quite as good a collection of specimens of the rocks of the high Alps, from which the different valleys descend, as the 'erratic blocks' used for building the castle towers and the city walls. To make the most important tool, the hatchet or celt, a rolled stone was partially sawn through on opposite sides by means of flint saws, used with water and quartzose sand; it was then broken in two by a blow. After this operation came the still more laborious affair of finishing the tool by strokes of stone hammers, and grinding it on slabs of sandstone. By a similar process the corn-crushers and beating-stones, or stone hammers, received their form; a coarser sandstone was always selected for these instruments.

The flint used for saws, for arrow- and spear-points, came partly from the Swiss Jura, and partly from France and Germany. The instruments for working the flint, probably consisting of the same material, have never yet been found, or at any rate recognised;[1] and yet it is probable, nay, almost certain, that many flint implements were actually made in some of the lake dwellings, as, for instance, those of the lake of Constance. Flint hatchets are never found with us, and in general the flint implements of Switzerland bear no comparison either in variety of form or in the grinding and polishing of the work, with those found in the northern countries of Europe.[1]

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[1] I have in vain searched in the reports of Schoolcraft (Smithsonian Institution) and in many other books of travels for an account of any possible way in which the wild races of America manage to make their spear and lance-points of flint and obsidian merely by some pieces of the same stone and without the use of any metal. Even the people who work the common flints as a trade can give no sort of idea how the ancient flint implements were made without metal tools, especially those from Scandinavia, which are so artificially formed.

[*Flakes* of obsidian were made in Mexico, and those of chert by the Esquimaux, simply by strong pressure. See Sir John Lubbock's very interesting work, 'Prehistoric Times,' pp. 77, 78, and 79.—TR.]

We have now to draw attention to a kind of stone which in all probability was an object of barter, viz. nephrite; it is found in all the older settlements, and most plentifully at Meilen. Though there may be some small amount of doubt still remaining, yet mineralogists assure us that it is not met with in Europe, but in Egypt, in China, and other parts of Asia, also in Oceania. If so, it follows that even at the period of the earliest lake dwellings there was a traffic between the West of Europe and the countries of the East. The objects found in the tumuli which are identical seem to bear out this view. If we do not mistake, the nephrite, which was the mineral most valued for celts or hatchets, was imported already worked. The fragments of a broken implement were again ground and brought into use, but no unworked mass of nephrite has yet been found in the lake dwellings. We have already expressed our opinion in the account of Robenhausen that its inhabitants did not bring nephrite with them, but only received this valuable mineral after a sojourn of centuries in this locality. If so this can only have happened by barter.

The glass bead also found in the very early settlement of Wauwyl serves to indicate a trade by sea either with the

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[1] With the exception of the flint hatchet or celt which, as above mentioned, is not found in Switzerland, the objects found in our oldest lake dwellings agree entirely with those of the oyster heaps (Kjökkenmöddinger) of Denmark, which, according to Worsaae, in the 'Athenæum,' No. 1,679, December 31, 1859, p. 889, contain 'broken bones of stags, deer, bos urus, beaver, wild boar, &c., together with charcoal ashes, burnt stones, pieces of very coarse pottery, rude hatchets, spear-heads, knives, arrow-heads, flakes or chips, chipping-blocks, &c., of flint; a sort of hatchet or hammer made of stag's horn, different implements of bone, and very simple ornaments of the same material.' Lake dwellings have also been discovered in the Lake Maribo in the island of Laaland like those of Switzerland, to which (on what grounds we know not) a greater antiquity is ascribed. From the fact of the flint implements of the oyster heaps having been made quite roughly, neither ground nor polished, and very similar to those found in different bone caves of England and France, and in the gravel beds of Abbeville and Amiens, Worsaae concludes that the oyster heaps belong to an earlier period than the great stone chambers and cromlechs, and probably are to be ascribed to a peculiar wild race, the actual aborigines of Western and Northern Europe, who in later times were destroyed by a more powerful and somewhat more civilised people, the builders of the cromlechs and the makers of the beautifully formed flint implements. While the author places the oyster heaps of Denmark chronologically, or rather in the history of civilisation, on the same footing as the deposits first named in England and France, from which deductions have been drawn that man lived at the same time as the elephant, the rhinoceros, and other extinct animals; he divides the stone age into two periods, and the oyster heaps are considered to belong to the first. See also 'Prehistoric Times,' pp. 191 and 192.

Phœnicians or the Egyptians, as mentioned in the account of the above lake dwelling.

The different kinds of flint originally derived from distant parts of France and Germany, which are worked up into knives, arrow-heads, and other implements,[1] seem also to indicate that the colonists had a barter trade to the North and West; and the piece of amber found at Meilen apparently points in the same direction, though it is very occasionally found in Switzerland, on the shores of the lake of Constance.

The bones of small animals and birds were used for pointed tools, spatulæ, chisels, and spear-points, and the larger instruments were made out of the ribs and the leg-bones of the roe and the stag, and the ulnæ of various ruminants. The hollow bones of these animals were cut into two parts lengthways by means of flint saws, generally along the arterial hollow, and thus when the fracture was fortunate each piece had an articulating end for a natural handle. The tool was then finished by means of the grinding slab of stone.[2]

Next to bone, horns, especially those of the stag and the roe, offered suitable material for making the larger pointed tools, daggers, &c.[3] The ends cut off from the main branch were sharpened on the grindstone, and sometimes also perforated at the thicker end, so as to be more conveniently worn or suspended. It is very singular that hitherto no implements have been observed made out of the horns of the ox, the goat, or the ram, and yet their bones are found in the dwellings. The tusks of the wild boar seem to have been especially chosen for cutting tools; those of bears or wolves for amulets.

With respect to wood, it was used in the first place in the shape of piles and boards to build the dwellings themselves.

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[1] Herodotus, vii. 69, says of the Ethiopians in the army of Xerxes, 'they had sharp arrows made of reeds, and pointed, instead of iron, with a kind of stone used to engrave their seals. They had also spears, the points of which were roe's horns sharpened, like lance-heads, and they also carried knotty clubs.'

[2] The following extract from the 'Travels in Peru and India,' by Clements R. Markham, Esq., London, 1862. p. 159, will show the use of bone weapons amongst the wild tribes at a late date, even long after they had become acquainted with European civilisation. It relates to the insurrection of the Inca Tupac Amaru, and the battle of Mananchili. 'The Indians left 370 killed on the field, among whom there were many women, who came to fight by the sides of their husbands and brothers, armed with *bones sharpened at one end*'—[Tr.]

[3] With respect to the use of flint flakes, my attention has been called by my friend the Rev. C. W. King, to the fact that the Mexican natives at the time of the conquest, according to Prescott, i. 107, carved 'the various stones and alabasters employed in he construction of their public works and principal dwellings with tools of obsidian, lthough they possessed bronze implements at the time.'—[Tr.]

Mallets and clubs were also made of branches which had grown in a wen-like form. Many small implements for domestic purposes were made out of wood. Large trunks of oak were hollowed out, either by fire or stone celts, and used for canoes, and oak poles were used for spear shafts.

Bast or the vegetable fibre of different shrubs was made into ropes and lines.

The earthenware vessels deserve a closer consideration; they are found in great abundance, but unfortunately chiefly in fragments. These vessels have probably been worked into shape in the lake habitations, but burnt on the mainland. The whole of the pottery may be divided into two classes, according to the nature of the material, one a coarser sort made of clay, mixed with a large quantity of grains of stone, and a finer kind made of washed loam, in some cases mixed with a small quantity of charcoal powder. The shape of the vessels in the older settlements does not vary to any great extent. Urns with a large bulge and thin sides are rare; very few flat vessels are found in the shape of plates; as a general rule the form approaches that of a cylinder. With respect to the ornamentation, which even the most uncivilised nations seem compelled as it were by nature to use in making their utensils, it consists only of bosses or impressions made either with the finger or a little stick. On some specimens, worked with greater care, a commencement of the zigzag ornaments may be seen; and some also are painted with graphite and ruddle. It is very certain that many of the large pots were used for cooking, for they are covered on the outside with soot. The thick crust on the inside of these vessels was caused, as I am perfectly convinced, generally by the burnt remains of a mass of corn-pottage which adhered to the sides of the vessel when the settlement was destroyed by fire.

We may conclude that the clothes of the colonists consisted partly of the hides and skins of wild and tame animals, more or less prepared. As it is certain that they had sheep, their skins would form the best clothing for the cold season. Flax, both platted and woven, also formed some part of their garments, as is clearly indicated by numerous specimens lately found.

The provisions of the settlers of the lake dwellings, judging from what has been already said, consisted partly of animal food, such as the flesh of wild or domestic animals, fish, and milk; and partly of vegetable materials, amongst which corn-meal, either boiled or baked, took the chief place. The fruit also of trees and shrubs growing wild was not despised, such as crabs and wild pears, sloes, hazel-nuts, and especially raspberries and blackberries. Remains of all these fruits have been found in large quantities at Wangen.

We will hereafter lay before the reader some conjectures as to the religious notions of the lake dwellers when the figures of the crescent moon are described, which we recognise as objects of worship. A special chapter will be devoted to them, as the subject is of importance; but it will necessarily be a short one, as there is really not much to communicate.

The preceding remarks have applied chiefly to those lake dwellings the characteristics of which belong to the earliest age, or what is called the stone period. This most primitive mode of living came to an end either before or about the time when a new material came into use, much more adapted for tools and weapons than stone. This was bronze, or a mixture of copper and tin, which, by a very simple operation, could easily be made into any required form, and which, as an article of trade, now began to be known in the Swiss districts. The exact point of time when this event happened, so important in the history of civilisation in Western Europe, and which contributed to the transformation and elevation of the physical condition of nations no less than the subsequent introduction of iron, cannot now be determined, even approximately, from the entire want of every chronological datum. Although the earliest inhabitants of these countries—the Celts, when they were first known to the Greeks and Romans, appear to have been well provided with bronze, and to have shown no common skill in managing the latter metal, as exhibited in the products of their foundries, lately brought to light, as well as those deposited in graves and tumuli, yet no author has ever mentioned—what could hardly have been passed by in silence—that they made use in war of bronze swords,[1] daggers, and spears, such as we see in our museums; and consequently the general use of these weapons must be thrown back into prehistoric times, and the first introduction of this material to an early part of the same period.

When once bronze had become general as a material for tools, and had gained a footing amongst the inhabitants of these settlements;[1] when the bronze celt was originally made just like the stone celt,[2] the new material must have asserted its influence on the lake dwellings, and on the arrangements and manner of life of the colonists. By means of these improved tools the wood could be squared and the whole building completed with much less trouble: larger oak trunks could now be made use of, and by a more advanced state of mechanical science deeper places in the 'weisser Grund' or shell-marl could now be made available for the settlements. This is especially the case in the lakes of Geneva and Neuchâtel, where there are several instances of settlements of two distinct ages in the same place, those of the bronze age being further from the shore and in deeper water. An increased supply of bronze allowed all implements used for handicraft, for war, for agriculture, and for domestic purposes, to be made out of this material, such as swords, spear and lance-points, daggers, knives, sickles, and even personal ornaments. Everything formerly made of stone and bone now consisted of bronze, and in many cases were actual copies of the earlier tools; and we find the whole series of bronze tools from native foundries[3] spread before us in great abundance and variety from the sites of the lake dwellings; only single specimens had hitherto been obtained from the graves or tumuli, or picked up by chance in the fields. On all these objects, but especially on the rings, lance-points, daggers, and knives, the ornamentation called Celtic was lavishly applied.

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[1] It is much to be regretted that many of our classical scholars will persist in translating *χαλκὸς brass*, when in at least nine cases out of ten it means bronze. The union of copper and zinc (the component parts of brass) was hardly known in ancient times, while that of copper and tin, in the shape of bronze, was universally known for ages. It is said that the lexicons give the interpretation brass; but if this is incorrect, why follow the lexicographers, and perpetuate an error?—[Tr.]

Contemporaneous with the perfection of bronze-casting, and the general use of implements of this material, very considerable advances were made in other handicraft arts, especially in pottery. To this period, though the use of the potter's wheel was as yet unknown, may be ascribed that great abundance of earthenware vessels, which in their shape show no small skill in the potter's art, and indicate a correct feeling in the workmen as to fitness and elegance, and which were finished by being painted black or red, and by the line ornaments before mentioned. Still at this period no vessels are found artificially formed with long narrow necks, like bottles, flasks, or jugs, so abundant in Roman times. On this account, the grade of perfection in the potter's art, amongst the lake-dwellers, and, in fact, generally amongst the pre-Roman inhabitants of Switzerland, must take a somewhat lower stand.

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[1] The large number of moulds for casting bronze described in the present volume sufficiently prove this.

[2] See Schreiber's 'Bronze Battle-axe.' It is quite certain that the stone celt, on account of its cheapness, continued in use till the iron age, and even till the early middle ages.

[3] In the year 1822 the owner of the manufactory at Wülflingen, near Winterthur, when digging deep in the ground to make a reservoir, found a space enclosed with sandstone filled with remains of fuel, and which proved to have been a bronze foundry. The walls had been burnt as in a furnace. Within it and near to it was found a quantity of bronze, by one account ten to twelve, and by another thirty cwts. in weight, partly in lumps and partly made into slabs, hatchets, swords, daggers, and pins. (See Gerold Meyer von Knonau, 'The Canton of Zürich,' vol. i. p. 56.)

When the settlers had become fully acquainted with bronze, and had learned to work it, the implements of the former period gradually went out of use, so that in settlements founded in the bronze age, like Morges, stone and bone implements are just as rare as bronze objects are in many of the dwellings of north and east Switzerland, which were destroyed or abandoned in the stone age. Still the number of settlements is considerable which belong to both periods, and in which the implements of both ages are found mixed together.

At some period after the introduction of bronze, the date of which cannot now be determined, but which yet falls under the prehistoric age, iron appears, probably at first very sparingly, and as an uncommonly valuable material: from the total absence of metallurgic knowledge, the reduction of this metal from the ore must have been exceedingly difficult. In the Swiss district, where, without any doubt, there was no iron-mining, either in pre-Roman or in Roman times, this most excellent of metals, as Pliny calls it, was procured by barter.[1]

As soon as iron became known to the settlers, their first endeavours were exerted to make the instrument most necessary to them, the axe or celt, out of this material; then other iron implements took the place of bronze, and differed from them in design and form as little as possible. Weapons and all household and agricultural implements, which formerly were made at the bronze foundry, were now prepared by the smith out of this most useful of all substances extant.

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[1] See the article 'The Iron Lumps in the Swiss Collections of Antiquities,' 'Anzeiger für Schweiz. Geschichte und Alterthumskunde,' 1858, Heft 3, in which I have brought forward the opinion that the pieces of iron found occasionally of the shape of a double pyramid, and weighing about twelve pounds, may have been the iron prepared for sale in the earliest times; these lumps or pigs are fully described in the Archæological Journal, vol. xvi. p. 200; they are not found near any Roman site. Within the last few years several remains of ancient iron foundries have been discovered in the northern part of the canton of Bern (see the 'Recherches sur les anciennes Forges du Jura Bernois,' par A. Quiquerez, 1866). Respecting the gradual disappearance of bronze, see von Bonstetten's 'Recueil,' p. 11.

It is further a matter of the highest interest, in studying these lake dwellings, to find that from the nature of the objects found in their ruins, the existence of many of them continued not only to the time when bronze was superseded by iron, but also extended into historic times. The discovery of Roman tiles, which probably were used, not so much for roofing, but, as is frequently the case in Roman buildings, for making the hypocausts, and for many other purposes, affords the most convincing proof that many lake dwellings still remained occupied when the inhabitants of Switzerland were known in history under the name of Helvetii, and were actually under the Roman sway. A great number of things, such as weapons, implements, and ornaments of many different kinds, which are constantly met with amongst the ruins of the lake dwellings, and of precisely the same form, also in tumuli, mark in a characteristic manner both the Helvetian and the subsequent Gallo-Roman periods.

No difference whatever is to be discovered in the construction of the lake dwellings, between those of the earliest and those of the latest age. The fact that the erections of the transition and bronze ages were built more substantially, and in deeper parts of the lake, may be explained by the use of better tools.

There is no ground for concluding that successive peoples of different races or civilisation have occupied these lake dwellings, or that one had chased another from its abodes, in order to occupy them themselves, precisely in the same manner as the previous inhabitants.

The following facts respecting the origin and the duration of the lake dwellings result from the investigations hitherto carried on. The oldest settlements of this kind, especially those in the lakes of east Switzerland, had their origin in that dark time when, at least in these districts, the use of metals was yet unknown. Of these settlements, a part had been destroyed either before or in the course of the bronze period, while another portion, as is shown by the numerous lake dwellings of the western lakes, were in their most flourishing condition precisely at the same period. This singular mode of settlement lasted the longest in the lakes of Neuchâtel and Bienne, where many of the lake dwellings continued to be inhabited through the iron period, and were probably not abandoned even at the beginning of our era.

With reference to the foregoing remarks respecting the first appearance of iron, and the continuance of lake dwellings till the Roman times, we may remark that a diligent investigation of the settlements both of eastern and western Switzerland will show us that Marin alone bears the distinctive characters of the iron age, although some implements even of the first iron age are found here and there in several stations. We may also rest assured that the Roman implements had no real connection with the lake dwellings.

If the question be asked, what can have been the original motive for erecting such singular abodes, it may be replied, that the same idea originated them all, namely, the isolation of the inhabitants, and the security of their life and property.[1] The situation, indeed, was not badly chosen for this purpose. As the neighbouring forests afforded plenty of game, and the lakes an abundance of fish, the inhabitants were equally well placed for fishing, for hunting, and for agriculture. The origin and the arrangement of these lake erections must, in general, have been everywhere the same.

It is very evident that their earliest founders came into Middle Europe as a pastoral people, and possessed the most important domestic animals, such as the dog, the cow, the sheep, the goat, and the horse. All these animals have their origin, not in Europe, but in Asia, and were brought here by the settlers through all their long wanderings from the East. They understood agriculture, and cultivated different kinds of grain (wheat and barley), also flax, plants which in like manner they did not meet with in Europe, but brought with them out of Asia, or received them by commerce from the South.

The endeavours of the settlers to live together in permanent abodes and in a sociable manner, is a positive proof that they had long known the advantages of a settled mode of life, such as appears in the lake dwellings,[2] and that we have to look upon them not as wandering pastoral tribes, still less as a mere hunting and fishing people. A settled union of a great number of men in the same place, and of hundreds of families in the neighbouring bays, would never have taken place if there had not been a regular supply of provisions at all times of the year, and some beginning of social order.

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[1] The fact, which has been previously mentioned, of many lake dwellings being actually contiguous to the mainland, does not seem entirely to accord with this view, unless it be assumed that in these cases the entrance was fortified by palisades. In fact, the discoveries lately made at Wangen of piles in the bank actually indicate the existence of such an arrangement.

[2] There must have been many slow transitions from pasturage to agriculture; there is never at the same moment a hard boundary-line between the two, and as the shepherds are the earlier in point of time, it cannot be a matter of surprise that many of their customs and arrangements remained amongst certain tribes who, for a long time, had tilled the ground. On the other hand certain wandering tribes may probably in the earliest times have attempted agriculture, perhaps few pastoral tribes ever existed entirely without it, and all agriculturists made use of meadows and pasture-grounds, though they probably gradually decreased in importance.

With respect to the mode in which many or most of the lake dwellings were destroyed, a sufficient explanation is given in the remains of woodwork found in their ruins and in the various objects altered or melted by fire. It is uncertain whether the huts were always burnt down by the hand of an enemy, or whether misfortune of some other kind caused their destruction. Besides this, we may conclude, with great probability, that this isolated, wretched mode of living, from which, especially in winter, all comfort was excluded, except within the huts, and which must have been so unfavourable to health, gradually fell into disuse, and was entirely given up when civilisation advanced and order was developed, and when the mode of living became more peaceable; just as, towards the end of the middle ages, the castles and strongholds were abandoned, because the change in the circumstances of their owners allowed them to find pleasanter and safer abodes on the plains.

It has already been remarked that, on comparing the implements of stone and bronze from the lake dwellings with those in the Swiss museums, some of which were found in graves and tumuli, and others met with by chance in the fields, we are not able to discover the smallest difference between them, either in material, form, or ornamentation; and we consequently consider ourselves authorised in ascribing all these specimens, which appear to have come from similar manufactories, to the industry of one and the same people. The identity of the inhabitants of the mainland and those of the lake dwellings appears still more striking if we compare the settlements founded by both classes, as well as their domestic arrangements. It is hardly necessary again to refer to the peculiarities of the settlement on the mainland at Ebersberg;[1] the remains of walls made of wattlework and clay, the floor also covered with clay, and the slabs of sandstone used for the hearth, form a complete picture of the huts of the lake dwellings. The implements found there consist also of stone, bone, horn, bronze, and earthenware. We find the stone celt, and the grinding-stone, the granite sling-stone, pointed tools of stag's horn and bone, figures of the moon made of stone and ornamented exactly like those found at Nidau, pins and personal ornaments of bronze, and clay spindle-whorls. With respect to the pottery also, amongst the vessels found at Ebersberg, there are a great many which, in material, in shape, and in the various ornamentations of stripes, dots, bosses, and painting are the most exact counterparts of those discovered at Wangen, Robenhausen, Meilen, Moosseedorf, Nidau, &c. Not a single trace of iron was found amongst the remains of the settlement at Ebersberg, so that its existence appears, like that of many lake dwellings, to have come to an end before the general use of this metal.

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[1] The reason why settlements such as that of Ebersberg are so seldom discovered, is, that the cultivation of the land, which, even in Roman times, was carried on to a considerable extent, has obliterated the remains of many of the oldest settlements; in fact, at present they are only to be met with in places which have never been brought into cultivation. And as they are not distinguished by outward marks—by earthworks or walls—they are for the most part recognised too late by the workmen, and not being properly investigated, yield under the most favourable circumstances only a few stone or bronze celts.

From what has been said, it is evident that at the time when colonies of a peculiar kind had settled down on the shores of the Swiss lakes, the valleys and hills were also scattered over with huts, which were only to be distinguished from those of the lake dwellers by being on dry land instead of standing on piles. The grade of civilisation attained by both the lake dwellers and the mass of the population was exactly the same. It is not impossible that the smaller places protected by walls, which have been discovered in increasing numbers by antiquaries on the hills and mountain ridges, may agree in age with the lake dwellings, and stand in relation to them as hill-forts to lake-forts. For the history of the development of the human race teaches us that the lower a people is in the grade of civilisation the less are single families held together by a social bond, and the races by common objects; the inhabitants of different valleys and districts attack each other, and war becomes a part of the occupation of man. It would, consequently, be a false conception to affirm that there was any ethnographical difference between the lake settlers and the remaining population of the country, and to assume that they were distinguished from each other either by descent or manner of life.

As no national distinction can be proved between the dwellers on land and the dwellers on the lakes, so in like manner no serious doubt can arise as to the identity of the people who first made use of stone celts, then made implements of bronze of admirable quality, and lastly, forged its weapons and tools out of iron. The difference of material used for the various implements marks the epochs which follow each other in the development of one and the same race, not the degree of civilisation of different peoples. An interruption of the civilisation which was gradually advancing, the entrance of a foreign element, is not observable if we examine the monuments still remaining, amongst which we may especially mention the burial-places, and the various implements of the pre-Roman time. In the very same graves and tumuli, implements of stone and bronze, precisely alike in form, have been found lying together, and this remark will apply in other graves to implements of bronze and iron. The products of the potter's art also are seen, with all their characteristic peculiarities, through all the stages of their development, and form links in the outward phenomena of the different periods.

We have now finally to say a few words as to the nationality of the people who erected these lake dwellings.

Believing as we do, from what has previously been stated, that the different settlements in what are called the stone, the bronze, and the iron ages do not indicate a succession of races or the destruction of one people by another, but merely different grades of civilisation amongst one and the same people, and a continued progress in handicraft ability; believing also that the lake dwellers did not form a peculiar caste, but, as is shown at Ebersberg and other places, belonged to the very people who at the same time lived on the mainland; and knowing that, according to the universal opinion of many French and English antiquaries, the bronze objects of a peculiar form and quite as peculiar ornamentation, like those found in the settlements both on the land and in the lakes, have always been attributed to the Celts; knowing also that history makes no mention of any other people but the Celts, who in the very earliest ages possessed the middle of Europe, and in later times received their civilisation from the Romans, we believe that it would be contrary to all the facts adduced to arrive at any conclusion but this:—that the builders of the lake dwellings were a branch of the Celtic population of Switzerland, but that the earlier settlements belong to the prehistoric period, and had already fallen into decay before the Celts took their place in the history of Europe.

The assertion that the Celts, on their first entrance into Europe, which lies far back, as we have just said, in prehistoric time, were acquainted with bronze, and immediately after they had spread over Central Europe, applied themselves to mining operations is unfounded. Though in later times they showed great ability in working this metal, yet a considerable time must have elapsed before they discovered the ore in their new abodes and manufactured the metal. Copper and tin, the component parts of bronze, were not found at all in some districts of which they had taken possession, and in others only in moderate quantities;[1] and it is probable that the Celts settled in Germany and Gaul, even in later times, obtained these metals by barter. The facts which have been here brought forward, and those revealed also by the graves and tumuli, prove that the remains of the stone and bronze periods, from the circumstances under which they are found, exhibit the different stages of development of one and the same people, and it therefore appears to us inadmissible to call in the Iberians or the Finns or some unknown people as the representatives of the stone age in Central Europe.

Since the above remarks were written, an opinion has been expressed in many quarters, and more especially by my friend Professor Desor in his excellent work, entitled 'Les Palafittes, ou, Constructions Lacustres du Lac de Neuchâtel,' that the lake dwellings of the early age were mere temporary abodes, while those of later date were magazines, arsenals, or places of meeting.

Now it appears to me that these theories do not agree with the facts brought forward in the present volume; and I trust that my friend will pardon me if I dissent from his opinion. Discussion is the road to truth, which is the end of all our investigations.

The theory of a mere temporary abode or place of refuge is, in my opinion, contradicted by the following facts:—

The enormous amount of labour required for the erection of these settlements, whether on piles or fascines.

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[1] There was not a single copper-mine of importance at work in Gaul in Cæsar's time (Plin. xxxiv. 2); and the same authority says that even the Britons, whose country is so rich in copper and tin, procured their bronze from foreigners, Cæsar *B. G.* v. 12. From the fact that copper implements are not found in Central Europe, and a regular copper age cannot be shown in this district of country (which, like Gaul, had no tin and but little copper), it follows, as shown by Worsaae, 'that the bronze of the people who settled here was for a length of time obtained elsewhere, at any rate till the necessary mines had been discovered in Europe.' Worsaae concludes that the bronze was brought from Asia as an article of trade, and was then spread amongst the different nations of Europe. With respect to Middle and South Europe, which also had their stone age, but at an earlier date than the North, it seems the most natural to attribute the introduction of bronze to the Phœnician coasting trade, which, even as early as this, had engrossed that of the British tin.

The accommodation evidently afforded in each hut for the convenience of a family: the hearths; the large earthenware vessels for keeping food; the weights for looms, and the spindle-whorls for spinning flax; the pipkins covered either inside or outside with soot; and, in fact, all kinds of domestic arrangements.

The cattle and their stores, which were kept in the lake dwellings.

The repeated repair and re-erection of the settlements after having been burnt; and the relic-beds, lying one above the other, with their enormous quantity of bones and remains of domestic implements.

The fruits and seeds which had been used as food, and which, as pointed out most clearly by Professor Heer in his interesting work on the plants of the lake dwellings, indicate in a most singular manner that these settlements were used all the year round.

The non-existence, on any of the shores or banks near the lake dwellings of the stone age, of any similar remains. Not a stone celt nor a fragment of pottery, nor a corn-crusher, nor any appearance of a corresponding shore settlement, has yet been found.

It appears to me that these facts taken together disprove the theory of a mere temporary abode.[1]

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[1] The above remarks appear in the original in a more extended form, as the Preface to the Sixth Report. Dr. Keller told me that this preface might probably be omitted with advantage; but as I have more than once heard the theory of temporary occupation mentioned in England, I obtained his consent to the insertion of a very short epitome of his arguments. It seems to me that anybody who has the courage to read through the mass of information contained in the present volume *must* disbelieve the 'temporary' theory.—[Tr.]

The occurrence of these pile settlements peated up in the age of polished stone, while hardly any lake dwelling has, I believe, yet been found in peat which goes back to the palæolithic period, seems to confirm the opinion expressed by Belgrand in his splendid volumes on the Seine (a work of no common order), that the palæolithic period was one of great rain, the floods from which would not permit the peat to be formed; but that, when this rain ceased or diminished, the waters became quieter and less turbid, and peat began to grow in lakes and shallow streams, and that this later period coincides with the appearance of the early pile dwellings. Belgrand's work is well worthy of study; it was published in two beautiful volumes in 1869. And the same idea was independently worked out by an English geologist, Mr. A. Tylor, F.G.S., who communicated his investigations, which were very full and of long continuance, to the Geological Society in 1867. Objections seem to have been made at first to this 'pluvial' theory, but I am informed by Mr. Tylor that subsequent writers, such as Principal Dawson in America (see the 'Leisure Hour,' 1871, p. 757); Professor T. Rupert Jones ('Newbury District Field Club,' 1871-2, p. 23); Professor Morris ('Lecture on the Geology of Croydon,' 1876, p. 21), and several others in

Probably this is the most suitable place to insert a few quotations, from ancient authors, which show that the plan of building upon piles was known in the early days of written history.[1]

We will begin with Hippocrates, to whose works our attention was directed by Mone in his 'Zeitschrift für die Geschichte des Ober-Rheins,' xvii. 4, p. 405. This physician was born about 460 B.C., and the passage occurs in his treatise 'De Aeribus &c.' xxxvii. It runs thus:—

'Concerning the people on the Phasis (now Rioni), that region is marshy and hot, and full of water, and woody; and at every season frequent and violent rains fall there. The inhabitants live in the marshes, and have houses of timber and of reeds constructed in the midst of the waters; and they seldom go out to the city or the market, but sail up and down in boats made out of a single tree-trunk; for there are numerous canals in that region. The water they drink is hot and stagnant, putrefied by the sun, and swollen by the rainfall, and the Phasis itself is the most stagnant and quiet flowing of all rivers.'

The next author to be quoted is Herodotus, who was born about 404 B.C. The passage, v. 16, shall be given as translated by Professor Rawlinson.

'They, on the other hand, who dwelt about Mount Pangæum and in the country of the Doberes, the Agrianians and the Odomantians, and they likewise who inhabited lake Prasias, were not conquered by Megabazus. He sought indeed to subdue the dwellers upon the lake, but could not effect his purpose. Their manner of living is the following: platforms supported upon tall piles stand in the middle of the lake, which are approached from the land by a single narrow bridge. At the first the piles which bear up the platforms were fixed in their places by the whole body of the citizens; but since that time the custom

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Europe, have inclined to the view. The present volume, however, is not geological, and any discussion on this theory would be out of place. But as it appears to me that many of the lake-dwelling facts, *as far as they go*, seem rather to favour it, I do not think that it ought to be entirely ignored.—[Tr.]

[1] In the 'Anzeiger,' No. 35, for 1870, page 120, there is a curious notice of a tribe living near the mouths of the Danube who built their huts on the edge of the rivers or the sea. The quotation is given in a letter to Dr. Keller by Dr. Horstmann from '*Mauricii artis militaris libri duodecim*,' Upsala 1664. He appears to have been a writer in the sixth century after Christ. The inhabitants seem almost to have been amphibious. They had two doors to their huts, and if disturbed rushed into the water, and, by means of long hollow tubes through which they breathed, kept below the surface for hours; but as there is no mention of actual piles, they can hardly be said to belong to the races now under consideration.—[Tr.]

which has prevailed about fixing them is this: they are brought from a hill called Orbelus, and every man drives in three for each wife that he marries. Now the men have all many wives apiece, and this is the way in which they live. Each has his own hut, wherein he dwells upon one of the platforms; and each has also a trap-door, giving access to the lake beneath; and their wont is to tie their baby children by the foot with a string to save them from rolling into the water. They feed their horses and their other beasts upon fish, which abound in the lake to such a degree that a man has only to open his trap-door and to let down a basket by a rope into the water, and then to wait a very short time, when up he draws it quite full of them.'

We come now to later times: the other quotation we have to give is from Abulfeda, a geographer and a Syrian prince, born A.D. 1273, and died in 1332. The passage, to which my attention was directed by Professor Hitzig, occurs in the 'Supplementa tabulæ Syriæ,' cap. ii., and runs as follows, translated into English:—

'The Apamæan lake consists of an innumerable number of smaller lakes and reedy places. Two of them, however, are larger than the others, one to the south and the other to the north. The water of the Orontes pours into them from the south; in fact it makes these lakes, and then runs from them northwards. Of these two lakes then, one, as before said, to the south is the Apamæan lake, about half a parasang (nearly two English miles) across; it is not quite as deep as the height of a man. But the bottom is so muddy that no one can stand upon it. It is everywhere surrounded with reeds and willows, and in the middle of the lake there are quantities of reeds and flags; so that one cannot take in the whole lake at a glance, as these reeds hide part of it from view. Many kinds of birds live in this and the other lakes, such as the . . . . and the auk, and birds which feed on fish, such as . . . . and other aquatic birds in such numbers as are not found to our knowledge in any other lake. In the spring-time the yellow water-lily grows so luxuriantly, and covers the whole surface of the water with its leaves and flowers to such a degree, that vessels going through that lake have to pass through a regular wood of water-lilies. Between this southern lake and the northern one, there is a wood of reeds, through which there is a narrow channel, by which vessels pass from the southern to the northern lake. This latter lake is reckoned amongst the land of Hesu Borzajjah, and it is commonly called the lake of the Christians, *because it is inhabited by Christian fishermen, who live here on the lake in wooden huts built upon piles.*'

To these notices of pile dwellings from ancient authors and inscriptions, a number of instances of erections somewhat similar might be added from modern history and travels; but as most of them have already been collected and published by other authors, we will only mention two or three cases, one of which was inserted in the first report on lake dwellings in the 'Transactions of the Zürich Archæological Association.'

This notice is taken from the account given by Dumont D'Urville of the bay of the city of Dorei, in New Guinea ('Histoire,' vol. iv. page 607). 'The inhabitants,' he says, 'are distributed in four villages at the edge of the water. Each village contains from eight to fifteen houses built on piles; but each house is composed of a row of distinct cells or cabins, and contains several families. Some of these houses contain a double row of cabins, separated by a passage which runs from end to end. These buildings are entirely made of wood very roughly worked; they show the light through in all directions, and often shake when anyone walks over the floor.'[1]

The fishermen's huts which still existed in the river Limmat at the end of the last century were of a similar nature.

Another instance will be found in the 'Notes connected with the Dahoman, by Captain R. F. Burton, late Commissioner to Dahome, V.P.A.S.L. &c., and refers to the tribe called Iso or Yso.' 'This is a tribe which during some forgotten war fled from Dahome and established itself in a lagoon called *par excellence*, the Nohwe, and christened in our charts Denham waters, by the gallant naval officer of that name. The Dahoman king is sworn never to lead his army where canoes may be required; these Iso, therefore, have built their huts upon tall poles about a mile distant from the shore. Their villages at once suggest the Prasian lake dwellings of Herodotus, and the Crannoges of Ireland and the Swiss waters. The people are essentially boatmen: they avoid dry land as much as possible, and though said to be ferocious, they are civil enough to strangers. In June 1863, I moored my little canoe under one of their huts, and I well remember the grotesque sensation of hearing children, dogs, pigs, and poultry actively engaged aloft.' —'Memoirs of the Anthropological Society,' 1863–4, vol. i. page 311.[1]

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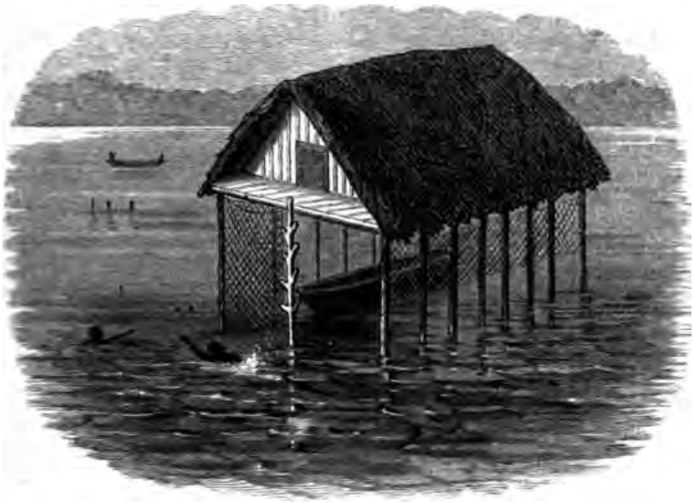
[1] I cannot resist adding one more instance, in a note, as the name of the place arose from the nature of the erections found there. The quotation to be given is from Justamond's translation of the Abbé Raynal's 'Settlements and Trade of the Europeans in the East and West Indies,' vol. iv. p. 68. 'Alphonso Ojeda was the first who reconnoitred, in 1499, the country called Venezuela, or Little Venice, a name that was given to it because some huts were seen there fixed upon stakes to raise them above the stagnant waters that covered the plain.'—[Tr.]

Since the first edition was published, a work of no common interest has appeared, viz., the Travels of Captain Cameron, R.N., 'Across Africa,' in two volumes, 1877, Daldy, Isbister, & Co. London.

At vol. ii. page 63, it is stated that in 'lake Mohrya, about 7.20 S. lat. and 25.40 W. long. there were three villages built on piles, and also a few detached huts scattered over its surface.'

FIG. 35.



These huts appear to have been erected in this manner as a precaution against the slave-catchers; and Captain Cameron could not prevail on the natives to lend him boats to go to them, so that all he could do was to examine them carefully with his field glasses. 'The lake,' he says, 'was small, the open surface of the water being an oval of two miles long by one wide, the longer axis lying ENE., and WSW., and around the margin was a belt of floating vegetation. I could easily distinguish the huts, and noticed that they were built on platforms raised about 6 feet above the surface of the water, supported on stout piles, driven into the bed of the lake. Some were oblong and others round, the former usually having a projecting roof over the door. Their roofs and walls appeared to be constructed in a manner precisely similar to that of the huts on shore. Underneath the platforms canoes were moored and nets hung to dry. Men were swimming from hut to hut, notwithstanding reports I had heard of enormous snakes, whose bite was fatal, inhabiting the lake. The people live entirely in these huts with their fowls and goats, and only come ashore to cultivate provision grounds, and bring goats to graze. Their canoes were simply "dug-outs," 20 or 25 feet in length.' The woodcut, Fig. 35, is copied from that of 'Captain Cameron's Travels,' vol. ii. p. 65, and the general view of the lake, Plate CCV. is copied from his sketch given in the same volume, p. 63.[1]

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[1] I am indebted to E. B. Tylor, Esq., F.R.S., the well-known anthropologist, for informing me of the above notice by Capt. R. F. Burton.—[TR.]

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[1] I have to return my best thanks to Captain Cameron, and also to the publishers, Messrs. Daldy, Isbister & Co., for kindly allowing me to copy these two plates.—[Tr.]

CRESCENTS.

We have now to draw the attention of antiquaries to a class of objects respecting which there may possibly be a difference of opinion, but which, in any case, are of the greatest interest. Amongst the antiquities found in the mainland settlement of Ebersberg, when examined some years ago (see Plate CXLV. figs. 5 and 17), and of which an account is given towards the close of this volume, there were some objects precisely similar to those now about to be described, and which were then considered to be symbolical representations of the crescent moon, and to be connected with the religious worship or, at least, opinions of the lake-dwellers. To this determination of these objects we still adhere, after a careful consideration of all the arguments respecting them, believing as we do that, though they may resemble, as is thought by some antiquaries, the horns of oxen, yet on the whole the probability is greater that they were intended to represent the crescent moon.

Since then a considerable number of similar specimens, both in red sandstone and earthenware, have been discovered, chiefly in the lake of Bienne; as yet they have not been met with in settlements of the earliest age. About two dozen of those made of clay with quartz grains were found by the late Colonel Schwab at Nidau Steinberg; these specimens are flattened on both sides, and not very thick, but as they were intended to stand, they are provided with a broad base. On the whole they do not differ much in size, the space between the points of the horns, measuring from 8 to 12 inches, and from the base to the point about 6 or 8 inches. As may be seen from the drawings, Plate XXXVII. figs. 9, 15, and 16, and Plate XC. fig. 16, in some specimens the representation of the crescent moon has been tolerably well given; in others the workman has been satisfied with the mere indication of its form. All these figures have on one side the same zigzag and line ornaments as are found on the pottery of the tumuli and on the bronze implements. They are very like those found at Ebersberg; the only difference being that the stone specimens have the horns more slender, and yet, on the whole, the body of the figure is thicker. This would not have succeeded with the images made of clay, for if made thick the mass would certainly have gone to pieces in burning.

Several of these crescents, drawn Plates LXXX. and LXXXI., were found at Cortaillod. The section is generally narrow, but somewhat broader near the oval base. In Plate LXXX. figs. 1 and 2, the horns run to a point; in Plate LXXXI. figs. 1 and 6, these points are cut off straight across, thus terminating in a flat surface, and in the latter this small flat surface is hollowed. Plate LXXX. fig. 1 is ornamented with lines representing the platting of a mat. Fig. 2 is ornamented on both sides with straight lines made of a series of impressed dots. Fig. 1, Plate LXXXI. has at each end a deeply impressed hole, round which there is a line drawn by the finger, which is continued in a serpentine form along the borders. Fig. 6 is the point of a moon image, which is perforated, and besides this is ornamented above the hole with engraved circles. On the flat surface there is a fillet running from one point to the other, which, as well as the upper border of the image, is ornamented with diagonal lines. This very singular specimen is in the collection of M. Desor.

Crescents of this kind have been found in other localities, but it is needless to multiply examples.

If we inquire what these things were intended for, it will follow, if we carefully examine them, that they cannot possibly have had any practical use,[1] but were probably placed either inside or outside of the house as ornaments, or more likely as objects of worship. But now comes the question, whether, in ancient writings or on monuments, any proofs can be discovered that the worship of the moon formed a part of the religion of the Celts, to whom we ascribe the erection of the lake dwellings. We certainly do not find one single positive evidence of moon worship amongst this people, but it is especially mentioned as prevalent amongst the Germans. Cæsar, in the Sixth Book of his Commentaries, in which he treats of the religion of the Celts, does not mention the worship of the moon. With respect to the monuments representing the Druids with the crescent moon, their falsity has been proved long since. The inscriptions also of the Gallo-Roman period, which have been so often quoted, give no certain information on the matter. And yet there are sufficient proofs that the moon had a share in the mysteries of the Druids, and was honoured and reverenced as holy. For the half-moon appears very certainly amongst other symbols on

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[1] Since the above was written, the use of these stone and earthen crescents has been fully shown, at least according to the views of many antiquaries. See notes on pp. 178 and 338.—[Tr.]

Gaulish coins, more particularly on those which we may especially consider as Helvetian (see vol. iii. part iv. of our 'Transactions'). But the passage in Pliny, xvi. 95 (xvi. 44 of the Edit. Dalecampii, 1587), is the most significant, in which he describes the ceremonies which took place when the Druids cut the mistletoe from the oak. According to the corrected text of Sillig, the passage runs as follows: 'Est autem id (viscum) rarum admodum inventu et repertum magna religione petitur et ante omnia sexta luna, quæ principia mensium annorumque his facit, et sæculi post tricesimum annum, quia jam virium abunde habeat nec sit sui dimidia, omnia sanantem appellantes suo vocabulo.'[1] This account that the moon, according to the religious ideas of the Gauls, possessed mysterious medicinal power, and was honoured under the name of 'all healing,' completely clears up, as it appears to us, the meaning of the figures of the crescent moon found in the lake dwellings and the corresponding settlements on the mainland. They were sacred emblems of the 'natio admodum dedita religionibus,'[2] by means of which, as with the branches of the mistletoe, they imagined that they were able to avert and to cure diseases. This panaceum was probably erected in some open space, perhaps over the doors of the dwellings; so that the ornamented side was exposed to view. From the fact that three moon images were found in so small a space as the excavation at Ebersberg, and a considerable number in some of the lake dwellings, it is reasonable to conclude that they were numerous in the Gaulish villages, and probably no house was without so important a palladium.[3]

Connected with these crescents of stone and earthenware may be mentioned the bronze implements, most of which are in the collection of the late Colonel Schwab of Bienne, and which decidedly bear the figure of the half or quarter moon. Plate XC. fig. 8, is of this form, with a broad latticed handle fastened to the convex side. Like the bronze sickles, one side is flat, and the other has raised ridges upon it. Though a bronze casting, it is very thin, and is not capable of bearing any pressure whatever. The one drawn Plate XCIII. fig. 8, is very similar, but it is rather larger, and the outside terminates in a sharp cutting edge. Plate XCII. figs. 6, 7, and 8, on the contrary, have no cutting edge. Fig. 7 is ornamented on both sides with raised lines.[1]

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[1] 'The mistletoe is not commonly met with, but when found, it is gathered with great solemnity, and especially on the sixth day of the moon, which they reckon as the beginning of their months and years, and of a period of thirty years, because it then has sufficient power and has not yet become half. They call it (the moon on the sixth day) 'all healing.' The clause 'omnia sanantem,' which can only be taken in reference to 'sexta luna,' is in many editions erroneously separated from the context.

The passage in Pliny, xxix. 12 (xxix. 3, of the Edit. Dalec.), also refers to a secret power of the moon. The words 'certa luna,' here used when the Druids were taking the serpents' eggs, probably mean also the first quarter of the moon.

[2] C. Jul. Cæs. *D. B. G.* vi. 16.

[3] See the note on page 178.

Plate CXIV. fig. 18, shows the handle, and fig. 14 the middle portion, of similar instruments found in the Marniera of Campeggine; the latter differs in some slight particulars. Amongst the specimens found in the settlement of Uetliberg on the mainland, is the handle of an implement evidently of the same nature; it is ornamented with studs placed irregularly, Plate CXLVI. fig. 9. All these implements were intended for suspension.

Very similar moon-shaped cutting instruments of bronze have been found in an Etruscan grave near Bologna; but in these cases the handle is not placed symmetrically, like those from Switzerland, but is fixed on towards the point of one of the horns. (See the treatise 'Di un sepolcreto etrusco scoperto presso Bologna, descrizione del conte Giovanni Gozzadini,' Bologna, 1855.) In the appendix to this interesting work, which is accompanied by excellent drawings, Professor F. Rocchi, in a learned dissertation 'intorno l' antichità dell' uso di radersi la barba,' points out the possibility of these implements having been used as razors. This explanation for a length of time did not seem satisfactory to me, as several of them were not sharpened, but perfectly blunt at the edges, so that they appeared to me to be merely ornaments in the form of a crescent. But since then, having seen and examined a number of specimens of various forms, I have come to the conclusion that they may in all probability be considered as cutting instruments of some kind or other. Implements of this nature would be required for cutting leather and cloth; and it must be borne in mind that as yet no scissors or shears have been found of this age. The fact of some specimens having a blunt edge may be explained by the necessity for its being well hammered, in order to make it cut. Bronze becomes denser, harder, and more fit for cutting tools by the process of hammering.[2]

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[1] From a late letter, Dr. Keller evidently considers these *bronze* 'crescents' merely as cutting instruments.—[Tr.]

[2] With respect to the hardening of bronze, there are several modes of accomplishing the point. See Caylus Rec. i. p. 242. It is now said to be practised to a considerable extent by several processes, one of which is simply the addition of a very small percentage of iron; a patent was taken out in England for this process some years ago.—[Tr.]

MANUFACTURES OF VEGETABLE FIBRE, FLAX, ETC.

AMONGST all the antiquities found in the lake dwellings, probably none are of more interest, or have a greater bearing on our ideas as to the civilisation of the inhabitants, than the various manufactures of 'bast' or vegetable fibre, and of flax. The variety of patterns is great, and apparently they have all been produced by very simple means.

Hitherto, specimens of this nature have been chiefly found in the lake dwellings of the earlier periods, though some have been met with in the settlements of later age, in the lake of Bienne.

Some surprise having been expressed as to the perfect preservation of these frail specimens of early industry, it may be well to state that we owe it entirely to the fact, that at the time the huts were destroyed, they fell burning into the water before they were entirely reduced to ashes, and were very soon after covered over by the mud of the lake.[1]

The need of fastening, binding, and sewing is one of the most primitive wants, and led men in early times to the use of simple threads and cords ready prepared for them by the hand of nature; these consisted either of objects taken from the vegetable kingdom, such as the stalks of the stronger kinds of grass; stems of reeds, twigs and fibres of trees, or materials from the animal kingdom, such as sinews and intestines, and skins cut into strips, the use of which, however, required a certain degree of preparation. By means of binding materials of this description, tools and weapons could be fastened to their handles, stems and branches of trees could be bound together, and huts erected. Binding or tying naturally led to platting and to forming a flat or extended surface, and hence arose mats and baskets, which the human hand is quite capable of preparing with the help of the simplest tools. Experience would soon indicate the best material afforded by nature, amongst which was flax, which possessed the requisite qualities in the highest degree. The use of flax, according to history, reaches back to the earliest period of civilisation, and was carried on in the lake settlements to a considerable extent. Flax was the material for making lines and nets for fishing, and catching wild animals; cords, for carrying the earthenware vessels and other heavy objects; in fact, one can hardly imagine how navigation could be carried on, or the lake dwellings themselves be erected without the use of ropes and cords; and the erection of memorial stones (Maenhirs, Dolmen), at whatever era and to whatever people these monuments may belong, would be altogether impracticable without the use of strong ropes.

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[1] To a geologist there can hardly be any difficulty in the matter; anyone who has looked over a collection of fossils from the fresh water formation of Œningen will remember the delicate vegetable fibres, exquisitely preserved in this rich locality; and these are not carbonised, but simply chemically changed. But there is no necessity to confine ourselves to a tertiary formation; let the same individual examine the vegetable remains from the old red sandstone (one of the palæozoic group) near Thurso, and he will cease to be sceptical as to the specimens of cloth from the lake dwellings. Indefinite preservation only requires a combination of circumstances, and these we fortunately possess in some of the lake dwellings.—[TR.]

After the different processes of working flax were in operation, such as spinning, entwining, platting, knitting, and weaving, and after the settlers had learned without trouble, and by a simple mode of manufacture, to prepare linen cloth, so admirably adapted for coverings and clothes, then appeared the innate propensities of human nature to give variety and elegance to the products of manual labour; and as we often see this tendency pleasingly shown in the mats of savages, so we find also in the products of the lake-settlers' looms numerous attempts at variety and ornament.

In describing and examining the many specimens of platted and woven cloth discovered by Mr. Messikomer at Robenhausen, and Mr. Löhle at Wangen, it will be necessary in the first place to take a view of the commencement of this kind of industrial exertion as shown in several specimens found.

Amongst the simplest means for binding and fastening, may be classed the ropes and cords formed by twisting together thin twigs, especially those of the willow; rough ropes of this kind have been found of various sizes, and resemble the handle of a basket.

Ropes and lines have also been discovered of less tough materials, such as rushes, reeds, straw, &c.

The bast or vegetable fibre (of the lime tree) was very commonly used, partly alone, and partly mixed with reeds and strips of flax.

The bast, in its most simple form, appears as a single strip or band, binding together pieces of wood or other materials; then we find these strips of bast twisted together so that the section is of a circular form, and still more commonly in the shape of rope, composed of several twisted bands entwined—a form of manufacture in which may be recognised the commencement of the ropemaker's art. Plate CXXXIV. fig. 1.

The mats platted out of strips of bast may be considered as the products of an advanced degree of industry connected also with the art of the basketmaker. The first and most simple kind of these mats, consists of a trelliswork of strips or bands platted crosswise one with another. Plate CXXXIV. fig. 2.

A second and more complicated kind consists also of a kind of trelliswork, of which the warp is made of twisted strips of bast and the woof of flat bands; the latter, probably more for appearance than for increasing the strength, are divided on the ridge of the cross piece into two, through which the next band is drawn, and then again united on the opposite side of the plat —an arrangement commonly found in the baskets and mats of the present day. Plate CXXXIV. figs. 3 and 4.

Plate CXXXIV. fig. 5, shows a series of small willow rods, arranged in a radiating form, platted together by strips of bast running concentrically in such a way that both together form a structure like that called 'herring-bone.'

In Plate CXXXV. fig. 1, double strips of bast are bound together very neatly by being platted with other strips of bast and cords.

In a third kind, the entwined strips of bast are wound round in the form of a spiral, and then bound together by flat bands. There are several varieties of this kind of platting, but we cannot venture on giving a detailed account of them.

One variety had evidently required much skill in the manufacture; it is not uncommon, but has never been found perfect; the use of it has not yet been determined. We cannot give the whole length of the object, but the point is drawn Plate CXXXV. fig. 2. It consists of a reed forming the central piece, and four splinters of the same material, which are platted together, and enclose the reed, like a 'core' or central portion in a cylinder. The specimens found vary both in thickness and also in the fineness of the work; the structure somewhat resembles that of our modern horsewhips which are bound round by cords.

Plate CXXXIV. fig. 6 is a piece of a mat platted out of bast, and differing from any other yet found. The front is regular and smooth, while the back, Fig. 7, is carelessly made. The broad bands by which the narrow double strips of bast lying in straight lines are platted together appear to pierce through to the lower side, probably to give more firmness to the plat. Fig. 8 shows the single bands separated, and gives an idea of the mode of manufacture.

Many other kinds of manufacture made of bast, or of bast mixed with twigs, have been discovered, but only in small fragments, and in such bad condition from having been burnt, that it is impossible clearly to make out their structure. It is, however, to the fact of their having been burnt that we owe their preservation; had it been otherwise we should probably never have known anything of these singular specimens of the industry of the lake-settlers.

No hemp has yet been found in any lake dwelling. The use of flax reaches back to the very earliest periods of civilisation, and it was most extensively and variously applied in the lake dwellings, even in those of the stone period. But of the mode in which it was planted, steeped, heckled, cleansed, and generally prepared for use we can form no idea, any more than we can of the mode or the tools employed by the settlers in its cultivation. Still less can we decide whether, as was the case with all the ancient Eastern nations, the preparation of the flax, and the spinning and weaving, fell to the lot of the female part of the community. The specimens of unworked flax, or that in stalks with the seed-vessels attached (of course burnt), belong, according to the opinion of the best judges, to the variety which is very generally cultivated in the north-west of Switzerland under the name of short flax. Even in the best soil this smaller kind never grows as high as the larger sort; it is simply preferred because it yields finer fibres, bears the climate better, and is not so easily laid by the wind.

Rough or unworked flax is found in the lake dwellings made into bundles, or what are technically called 'heads,' and, as much attention seems to have been given to this last operation, it was perfectly clean and ready for use. The mode of working this description of flax (that is, without being spun or twisted) is shown in various kinds of platted work. The most simple kind of this manufacture is drawn Plate CXXXV. fig. 3. We see here strands of this material laid in straight lines close to each other, and bound round and fastened together by similar strands. Flax brought into this form might be used as a mat, or a covering to wrap round the person.

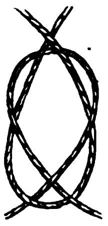
A remarkable and very complicated union of strands of flax and bast is represented Plate CXXXV. fig. 4. It consists of two different layers, the lower of which is thick and soft, and is made up of a number of strips of flax, ranged parallel to each other, one row overlapping the next like tiles, Fig. 4 *a*. Nothing could be ascertained as to the arrangement of these rows inside, as the specimen was so much burnt; apparently, however, each row was formed of a single strip worked sinuously backward and forward.

The upper layer of this plat consists of long narrow strips of bast, placed double, and ranged parallel with those of the under layer; in fact, so that every two strips of the bast correspond or are equal in breadth to one of the strips of flax in the lower layer. At a distance of nearly an inch apart, which answers to the space occupied by the rows of the under layer, these strips of bast of the upper layer are bound together by a sinuous cross-band platted round them, Fig. 4 *c*, *a*, which is also made of two narrow strips of bast. One of these cross-bands is placed just over the edge of every row of the strips of flax in the under layer where they overlap. The mode of joining the upper layer of bast with the soft under layer of flax is remarkable. This is done by a narrow strip of bast, *b*, underneath *a*, placed above the opening or loop of every strip at right angles over the cross-band of the upper layer (see the lower *a* and *c*), and then both ends of it are drawn through the strip lying underneath, so as to enter from behind the strip of flax which is next to it, and thus fasten the cross-band to the under layer. Thus this narrow strip performs the double office of fastening the upper layer of bast to the soft under layer, and of binding the strips of flax themselves one to another. Fig. *a* shows the upper ends of the upright strips of bast placed double, one after the other: a thin cord or strip is drawn through these ends or loops to prevent them from slipping through the cross-band.

In another fragment, Plate CXXXV. fig. 5, the strap *b*, which joins the two layers together, is not to be seen. These two specimens are somewhat similar in character to that drawn Plate CXXXVI. fig. 4, hereafter described, which is entirely composed of flax.

Even before the discovery of the remains of actual threads it might have been concluded from the abundance of burnt flax fibres, and of clay spindle-whorls, Plate III. fig. 13, that the art of twisting raw flax into a thread was known to all the lake settlers, and formed one of their leading occupations. The bundles found at Robenhausen, both of simple yarn, and also of thread made of two or more strands twisted together, proved the great ability possessed by the settlers in the art of spinning. It is uncertain whether the yarn, the simple single twist, had any definite use, but the threads made of several lengths of yarn twisted together are met with in great plenty, and of various thickness, wound into skeins and neatly bound up, Plate CXXXV. figs. 6, 7, 8. String and rope, half an inch in diameter, made of several strands twisted together, occur, of excellent workmanship, as if they had been done by a ropemaker, Plate CXXXV. figs. 9 to 15. The beautiful balls or hanks of string, Figs. 2 and 6 on Plate XIV. have been already referred to in the account of Robenhausen. As navigation, fishing, and hunting were apparently carried on to a great extent by the inhabitants of the lake dwellings, it may be readily imagined that the production of cords and ropes must have been a very important matter.

FIG. 36.



Of plats and netting made from flax spun into threads the first thing which may be noticed is the kind of knot used. Plate CXXXVI. fig. 10 represents a regular weaver's knot, and the annexed woodcut is the same a little loosened. Plate CXXXVI. fig. 9 is an entwined mass of skeins of flax loosely twisted together; this specimen cannot be accurately examined, on account of its having as usual been burnt.

Of netted manufacture the most simple forms are the nets, which vary considerably, both in the strength of the cord and in the size of the meshes, according to the purposes for which they were designed, and yet they seem all to have been made in the same manner. Plate CXXXVI. fig. 2 gives a drawing of the medium sort of this manufacture used for hunting and fishing. Plate CXXXVII. fig. 2 shows the piece of a net with large meshes.

Plate CXXXVI. figs. 1, 3, 4 and 5 give the patterns of four kinds of platted cloth, remarkable both for their ingenious structure and for the accuracy and care of their workmanship.

The first, Fig. 1, is made by a number of small cords lying close to each other; it may have been used for a mat, a covering, or as material for clothing.

The second specimen, Fig. 3, consists of strong strings, which are bound together at certain intervals by double cross-strings. It forms a very strong cloth pervious to light and air.

The third, Fig. 4, is like the one first described, bound together with a single cross-cord; at the border, *a b*, the warp is turned round a thin string.

It is remarkable for having on one side strips of raw flax platted in the material in regular rows, and which afterwards had been cut open, and thus formed an artificial pile. This specimen throws some light on the fragments drawn Plate CXXXV. figs. 4 and 5, which were made in a similar way of strips of bast and of raw flax, and which have also the appearance of a pile. There can be no doubt that this material was used for clothing.

The fourth specimen, Fig. 5, according to the views of those versed in such matters, is also to be considered as a kind of platted cloth, though from the regularity of its make it might have been thought to be woven. The string forming the woof is entirely lost to view under the cross-strings ranged close together by which it is entwined. This firm and fine material evidently was quite adapted for garments.

Three pieces of woven cloth are drawn Plate CXXXVI. figs. 6, 7, 8, made not by the hand alone, but by some mechanical means which, however simple may have been its construction, must be considered as a weaving apparatus. The invention of the loom, that is, of a simple frame for stretching the longitudinal threads, with an arrangement for weaving in the cross threads, reaches back to primeval times.

The specimen, Fig. 8, where the threads of the woof cross the threads of the warp at right angles, is simple coarse cloth. The thickness of the threads, and the distance between them, varies considerably, and yet the number of threads, both in the warp and in the woof in a square inch of surface, is on the average between 25 and 34. Closely woven cloth has not yet been found, nor what was made with strong threads, nor, in fact, have any specimens come to light which in uniformity and regularity of work can even in a remote degree be compared with the products of the present day.

The next specimen, Fig. 6, differs from the last in having every alternate three threads apparently thicker than the other intermediate three, by which the cloth becomes ribbed.

The specimen, Fig. 7, is a piece of fringe, which may have been used for trimming garments; skeins of thread are woven into the heading of the fringe, forming a narrow thread border, and the other side of the skeins is then cut through, so that the threads hang down loose.

Plate CXXXVI. fig. 11 is the drawing of a kind of ribbon. The warp consists of two threads of unequal thickness, which interchange and form neat cross stripes.

One of the most singular specimens of manufacture from flax is drawn in the upper part of Plate CXXXVII. It is a piece of very strong platted cloth similar to that drawn Plate CXXXVI. fig. 1, but it is remarkable for having a four-cornered pocket of common simple linen cloth, like that drawn Plate CXXXVI. fig. 8, sewed on to it with thread and string.

But the most remarkable of all is the embroidered cloth discovered at Irgenhausen, and described in the account of that place. (See Plate CXXXIX. fig. 2.)

Plate CXXXVIII. fig. 1 represents the middle portion of some piece of clothing made of strands of flax neatly platted; probably it was a covering for the head, like the leather caps so much in use in many of the Swiss valleys. This cap is arched towards the middle. The outermost border and the third row of strips have been destroyed. Fig. 2 represents one side of what is called the strap of a sling; it was made by platting flax cords together. A portion of the string to which it was attached is shown on the right of the figure.[1]

At the close of this account of the cords, ropes, and platted work of twigs and bast, and the platted and woven flax cloth found in the lake dwellings, we have one remark to make, viz., that after a careful examination of the products of the last-mentioned kind, we have never found—with the exception of the pocket and embroidery just mentioned, and one other hem made by a needle—any kind of seam or appearance of the cloth having been cut out; so that, at any rate for the present, we adhere to the conjecture that this woven cloth was used as a kind of general wrapper, rather than made into clothes fitted for the different parts of the body.

On the other hand, we find many fragments of the simple cloth, drawn Plate CXXXVI. fig. 8, in which the empty spaces between the threads are filled in with some kind of material, so as to change the cloth, which originally is in its texture almost like a fine sieve, into something having the appearance of burnt paper, and to make it quite impervious to light. The nature of this substance can hardly be ascertained; it may possibly have been used to make the cloth waterproof. These specimens also naturally suggest the question whether the substance thus adhering to them may have been a colouring material, and whether they may not be considered examples of dyed or painted cloth, the making of which reaches up to the highest antiquity.[1]

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[1] 'Qui fundis ex lino vel setis factis (has enim dicunt esse meliores) contorto circa caput brachio dirigunt saxa.'—Vegetius *De re militari*, lib. iii. cap. 14.—[Tr.]

Looms.—When we received from Mr. Messikomer the first specimen of burnt linen cloth, which was, in fact, one of the most complicated patterns, we could not repress the conjecture that in that locality there had been a mixture of products of very different ages, and that the woven cloth might have fallen into the canal by accident from some place or other on the bank. Ignorance of metals and handicraft, arrangements of the most primitive kinds found together with products of an advanced industrial knowledge, as shown by machine-made linen cloth, appeared to us an impossibility in the history of civilisation. But a careful examination of the locality by geologists and antiquaries soon proved that there was no illusion in the matter, and that these questionable specimens are the actual relics of the lake-dwelling settlers, and belong to the same age as the implements of stone and bone.

This discussion as to the age of the woven cloth necessarily led to the inquiry, as to what might be the form and construction of the machine which enabled the inhabitants of the lake dwellings to bring to perfection such admirable manufactures. It is known from the writings of the ancients that weaving was very early brought to great perfection, and it is also known that at the present day very good cloth of various kinds is made in Arabia, Persia, and India, by machines of the simplest kind. Of one of the earliest civilised nations of antiquity, the Egyptians, we possess, in fact, not merely in their woven cloths the actual proofs of their proficiency in this department of industry, but we find on the monuments which they have left behind them representations of the whole process of preparing and working flax, heckling, spinning, twisting, &c.; and also drawings of two kinds of loom, one lying on the ground and one standing upright.[1] It was, indeed, possible that the specimens of woven cloth under consideration, even if found amongst the remains of flax stores and spinning-rooms, might have been brought here by commerce with some civilised nation; but all doubt vanished as to their having been made on the spot where they were found when Mr. Paur, a ribbon manufacturer of Zürich, noted for his knowledge of weaving machinery, and taking an interest in these early productions of his art, constructed an exceedingly simple weaving machine, by which with the greatest ease he made cloth of all the various kinds drawn Plate CXXXVI. And, as a further proof, he showed from indubitable evidence that the clay cones, described page 152, and drawn Plate XXXVIII. fig. 16 and elsewhere, are to be considered as constituent parts of the looms of the lake dwellings. If further proof were wanting, it may be given in the fact that in several rooms lately excavated by Mr. Messikomer at Robenhausen, at least half-a-dozen of these clay cones were found in each, so that weaving must have been carried on there to a great extent.

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[1] It is remarkable that Herodotus, only a page or two before describing the pile dwellings on lake Prasias, referred to elsewhere in this volume, relates a story as to two Pæonian brothers and their sister drawing the attention of Darius to the occupation of spinning flax, 'which was neither like that of the Lydians, nor of the Persians, nor of any of the dwellers in Asia.' This account will be found book v. 12, 13.—[Tr.]

Mr. Paur has favoured us with the following account of the mode which the settlers probably adopted to manufacture their woven cloth, and also of the simple machine required for this purpose.

It must, however, be fully understood that, with the exception of the clay balls, cones, or weights, the following account is *ideal*; but there is every probability of its being perfectly correct. There can be no doubt as to the great variety of patterns of cloth discovered; this account merely states what a very simple machine would be required to produce these various specimens.

'The first thing to be done is to arrange the yarn for the warp into simple sets of about forty threads each. What is called the "Rispe," or the crossing of the threads, is done by winding the threads crosswise on a wooden frame, as shown in the annexed woodcut, Fig. 37. The "Rispe" cord, *a*, drawn through crosswise, keeps the threads firm in this form. The sets of thread are next to be hung in a row as broad as the cloth to be made, on the warp staff *a a*, woodcut, Fig. 38, which rests on two upright forked stems or branches, and they are to be weighted at the lower ends by clay balls or cones. Instead of the "Rispe cord" of each separate set of threads two longer cords, *b b*, are now drawn through the whole breadth of the warp, see Fig. 38. The next step is to fasten by means of a slip-knot the first of every four threads to a round cross staff 1, Fig. 39. The second thread is then fastened to a second staff; the third to a third, and so on; so that the whole of the threads are distributed on the four staves, see Fig. 40. Lastly, the weights are to be hung on in such a way that only the threads from one staff are fastened to one and the same ball; when this is done, both the "Rispe" cords, *b b*, are taken away and the labour of weaving may begin.

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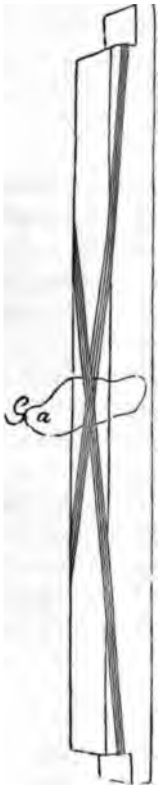
[1] Sir Gardner Wilkinson, ii. 60; iii. 135. The ancient northern loom is described in Worsaae's 'nordiske Oldsager,' p. 159.

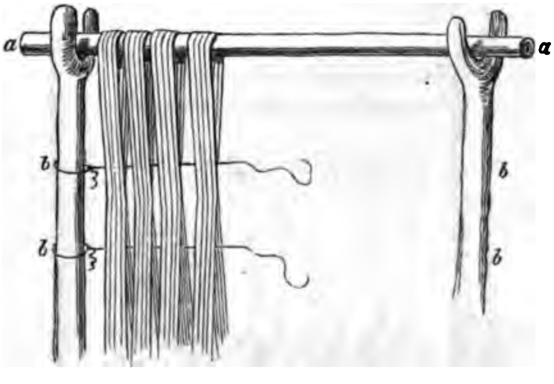
FIG. 37.



'The distribution of the warp on the different staves just described, enables the workman to draw out either one, two, or three threads and to let the others remain, and thus by this change of the threads drawn out to produce various kinds of patterns.

'The manufacture of the peculiar ribbed cloth, drawn Plate CXXXVI. fig. 6, yet remains to be described. Nine threads of the warp are fastened on four cross-staves in the following order:—

FIG. 38.



Threads	1.	2.	3.	4.	5.	6.	7.	8.	9.
on Staff	1.	2.	1.	3.	4.	3.	1.	2.	1.

At the first 'cast' of the shuttle, staff 1 is drawn.
" second . . . . 2 & 4 "
" third . . . . 1 "
" fourth . . . . 2 & 3 "

Fig. 39.

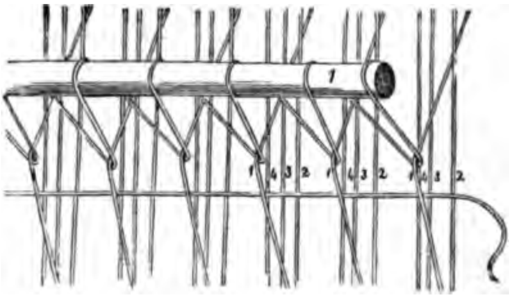
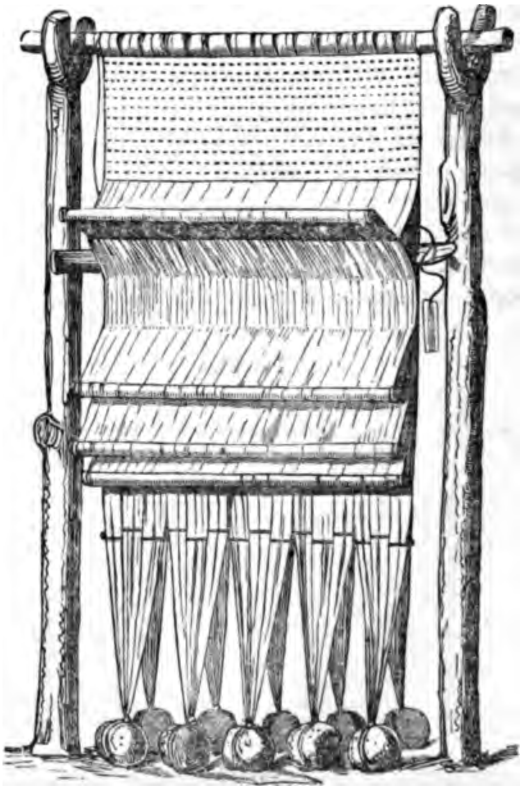


Fig. 40.



'The above arrangements are all that are required for manufacturing linen cloth exactly similar to all the varieties drawn Plate CXXXVI.'

LEATHER.

It was natural when men pressed forward into the inhospitable regions of Middle and Northern Europe, that they should feel the need of some clothing for the person to enable them to bear the rigour of the climate. A material well adapted for this purpose would be found in the hides and skins of beasts, either of those which followed the wandering tribes as domestic animals, or of those killed in the chase. The earliest clothing of the inhabitants of Switzerland cannot materially have differed from that which we see in our own day amongst the uncivilised people of the far north. The manufacture of stone and bone implements and of earthenware bowls, the construction of huts, and the preparation of skins and hides for covering the feet and other parts of the body, must have been practised amongst the settlers as one of their most indispensable labours, and have been carried on to a great extent. Unfortunately we possess only the most sparing indications as to this department of the settlers' economy, for the leather was entirely altered by the heat and spoiled by the water. And yet amongst the relics of the settlers which lie entombed in the mud of the bed of the lake, a number of pieces of leather have been found, the use of which is indeed unknown, but which still prove to us that some mode of preparing leather so as to make it supple and durable was not unknown, and that consequently the first elements, at least, of the currier's art were in use amongst the inhabitants of the lake dwellings. We will not venture to run into conjecture as to the mode in which the raw skins were treated; it will be sufficient at present to state the fact, of which we are assured by those versed in these matters, that the appearance of the leather found at Robenhausen certainly shows that it had been artificially prepared; and the late discovery of a wooden last in the same locality as described in the notice of this settlement, proves that the colonists protected their feet by some kind of sandals, in all probability made of leather.

ABSTRACT OF THE

TREATISE ON THE 'PLANTS OF THE LAKE DWELLINGS.'

BY DR. OSWALD HEER.

ZÜRICH, 1866.

[PROFESSOR Heer, to whom we have been indebted for previous information as to the plants of the lake dwellings, has lately published a most interesting work with the above-mentioned title, and in the kindest manner has allowed us to take extracts from it, and also to make use of his valuable illustrations.]

The remains of the plants referred to in this treatise are found lying in the lake mud, or buried under a bed of peat several feet thick. They have to be collected out of a soft, dark-coloured mud, which formed the ancient lake-bottom, and is now called the relic-bed. Stones and pottery, domestic implements, and charcoal ashes, grains of corn and bones, lie together in a confused mass. And yet they are by no means spread regularly over the bottom, but are frequently found in patches. The places where bones are plentiful, where the seeds of raspberries and blackberries, and the stones of sloes and cherries, are found together in heaps, probably indicate where there were holes in the wooden platform, through which the refuse was thrown into the lake; while those places where burnt fruits, bread, and platted and woven cloth are found, indicate the position of store rooms in the very places where they were burnt, and thus the contents fell into the water. The burnt fruits and seeds, therefore, unquestionably belong to the age of the lake dwellings; and a portion of them are in very good preservation, for the process of burning has not essentially changed their form. The same remark applies both to the apples and the corn, as the outer rind for the most part has neither separated nor shrivelled up. Many of the remains of plants, however, have been preserved in an unburnt state. But as, when these seeds are taken up out of the mud of the relic-bed, it is not impossible that plants and seeds from the neighbouring bank may get mixed with them, great caution is required in discriminating. Fortunately we have the means of distinguishing the ancient seeds and fruits from those of the present day, for, in the ancient seeds, the inside portions—the germ and albuminous part, have disappeared, and only the burnt cellular part, which forms the seed-shell or pericarp, has remained; consequently, all endeavours to make the seeds germinate have proved fruitless. Thus the seeds of raspberries, goosefoot, water-lilies, &c., are hollow inside, and in some cases only a brown powder indicates the remains of the former contents: the same remark applies to the stones of cherries and sloes, to hazel-nuts, cornels, the seeds of pond-weeds, &c.

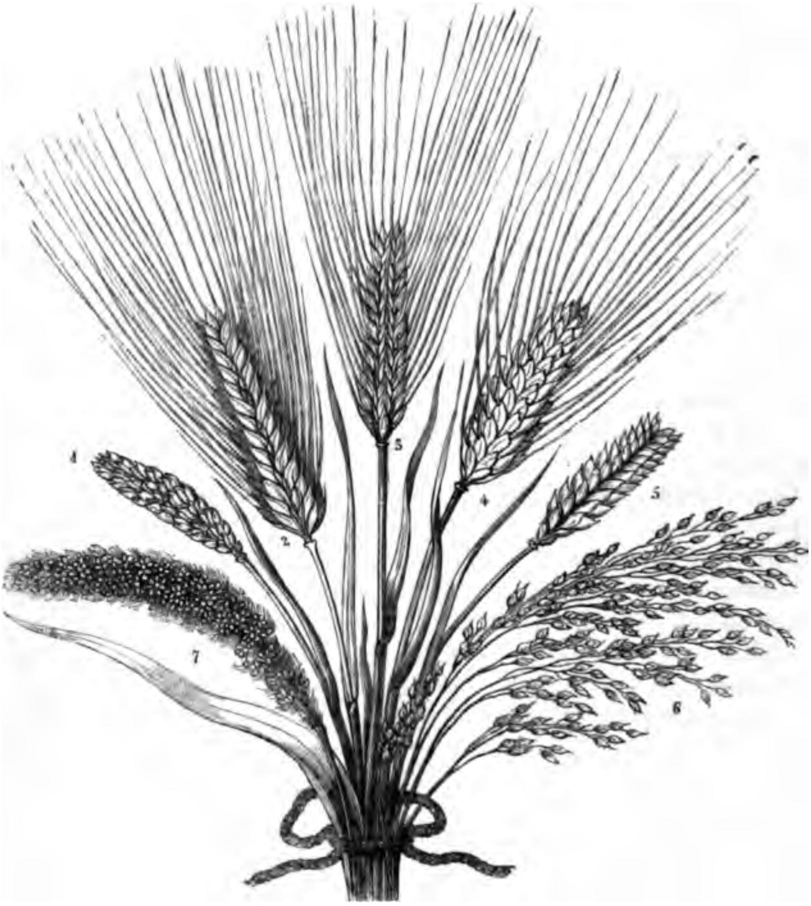
Professor Heer divides the plants hitherto found in the lake dwellings into—1. Cereals; 2. Weeds of the corn-field; 3. Culinary vegetables; 4. Fruit and berries; 5. Nuts; 6. Oil-producing plants; 7. Aromatic plants; 8. Bast and fibrous plants; 9. Plants used for dyeing; 10. Forest trees and shrubs; 11. Mosses and ferns; 12. Fungi for kindling fire; 13. Water and marsh plants.

1. *Cereals.*—The small-grained, six-rowed barley (*Hordeum hexastichum sanctum*), and the small lake-dwelling wheat (*Triticum vulgare antiquorum*), were the most ancient, most important, and most generally cultivated farinaceous seeds of our country. Next to them come the beardless compact wheat (*Binkelweizen — Triticum vulgare, compactum muticum*), and the larger six-rowed barley (*Hordeum hexastichum densum*), with the two kinds of millet, the common millet (*Panicum miliaceum* L.), and the Italian millet (*Setaria Italica*). The Egyptian wheat (*Triticum turgidum,* L.), the two-rowed wheat (*Emmer—Triticum dicoccum,* Schr.), and the one-grained wheat (*Triticum monococcum*), were probably, like the two-rowed barley, only cultivated as experiments in a few places; and the spelt (*Triticum spelta,* L.), which at present is one of the most important cereals, and the oat (*Avena sativa,* L.), appeared later, not till the bronze age, while rye was entirely unknown amongst the lake dwellings of Switzerland.

The millets are undoubtedly spring crops; in fact all the other kinds of cereals appear to have been the same. Consequently, the colonists must have prepared and sown their fields in spring, not in autumn; and the corn was probably housed at the end of summer, and no after-crops secured. The beds of goats' and sheeps' dung discovered in the lake dwelling of

Robenhausen seem to indicate that the fæces were allowed to accumulate in the stalls, in order to be used for manuring the fields. Bread was made only of wheat and millet, the latter with the addition of some grains of wheat, and, for the sake of flavouring it, of linseed also. Bread made of barley only has not yet been found, and it is probable that barley was chiefly eaten boiled, or more probably parched or roasted. The small, six-rowed barley of the lake dwellings is the sacred barley of antiquity. The small lake-dwelling wheat (*Triticum vulgare*

FIG. 41.



1. Small lake-dwelling wheat (*Triticum vulgare antiquorum*). 2. Compact six-rowed barley (*Hordeum hexastichum densum*). 3. Small six-rowed barley (*H. hexastichum sanctum*). 4. Egyptian wheat (*Triticum turgidum*, L.). 5. *Emmer* or two rowed wheat (*Tr. dicoccum*, Schr.). 6. Common millet (*Panicum miliaceum*, L.) 7. Italian setaria (*Setaria Italica*).

antiquorum) is probably the oldest sort; it is the most prevalent cereal in all the older lake dwellings, and it was cultivated down to the Gallo-Roman times.

The preceding woodcut gives a sketch of some of the more important kinds; it can hardly be called a 'restoration,' as in many cases the actual ears have been found.

We know very little as to the agricultural tools, though several implements have been found which are considered to belong to this class. Neither do we know how the corn was gathered, though in all probability it was not cut just under the ears (a mode which is represented on some ancient Italian coins), but the straw must have been taken up with it, otherwise there would not have been the seeds of so many weeds with the corn. It was then, probably, trodden out to separate the corn from the husks (thus the Roman term *triticum* from *triturare*), and after being cleaned, the barley may have been freed from its hard parts by a club. Implements of this kind appear on coins of Metapontum, amongst agricultural tools, and several clubs have been found at Robenhausen. The women of Southern Africa are mentioned by the Livingstones in their travels, lately published, as having to perform this operation with a kind of pestle and mortar. We know how the corn was crushed and ground; it is needless here to refer to the corn-crushers and mealing-stones found in nearly every settlement. Some of the meal was then made into bread, of which charred portions are still met with. In other cases, the grain was probably roasted, then crushed, and put into the pipkin, and the mass, after having been somewhat soaked, was then eaten. The Spaniards, when they conquered the Canary Islands, very singularly found this mode of preparing corn food prevalent amongst the aborigines; they adopted this custom, and have continued it to the present day. The corn there is still roasted in ovens, prepared for this especial purpose, then ground, placed in goatskins, and thus stored. This 'Gofio' as corn-meal is called, when thus prepared, forms now the food of the lower orders of the people in the Canaries, and may certainly be considered as the oldest form of making use of corn.[1]

Parched barley was the sacred corn of the ancients, and took a very important place in all their sacrifices.

2. *Weeds of the Corn-field.*—Some of these were indigenous, and others had been introduced with the cultivated plants, and

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[1] *Odyssey*, ii. 354. Telemachus does not take bread for his voyage, but meal in skins.

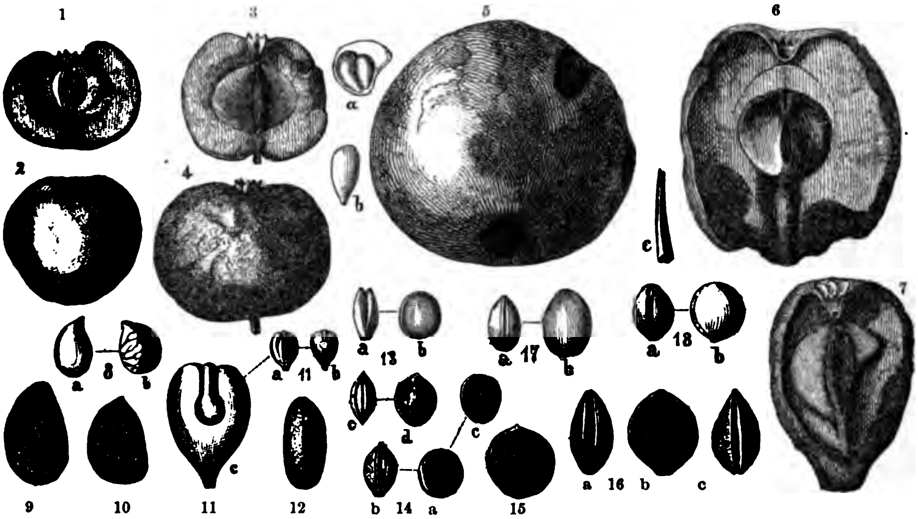
been sown with them. The latter were either permanent or mere transitory occupants of the ground. Some are charred, and most unquestionably were mixed with the corn when it was burnt. Others are found in great abundance in the mud, and when the wheat was cleaned, had been thrown into the lake as refuse. A fact of great interest is the occurrence of the Cretan catchfly (*Silene Cretica*, L.), in the remains of the lake dwellings, as it is not found in Switzerland and Germany; but on the contrary, is spread over all the countries of the Mediterranean, and is found in the flax-fields of Greece, Italy, the South of France, and the Pyrenees. The presence of the corn bluebottle (*Centaurea cyanus*) is no less remarkable, for its original home is Sicily. As it had already appeared in the corn-fields of the lake dwellings, it indicates the way by which corn had come into the hands of the colonists.

3. *Culinary Vegetables.*—With the exception of peas, no culinary or garden vegetables can, with any certainty, be mentioned as belonging to the stone age. The Celtic dwarf field beans (*Faba vulgaris*, Mch.), appear in the bronze age of a strikingly small size, such as are never found afterwards. The lentil also (*Ervum lens*, L.), belongs to the variety known as the small or field lentil (*E. lens microspermum*).

4. *Fruit and berries.*—Fruits like apples and pears are found in the lake dwellings, burnt, and in a very fair state of preservation; on the contrary, stone fruits and berries have not been burnt, and therefore only the stones and the hard seed-shells still remain. The apples are chiefly cut into two parts; seldom into three; the smaller ones are left whole. The sour crabs must have been of considerable importance as an article of food, as we may learn from the large quantity of their remains, and their general diffusion amongst the lake dwellings. Together with these wild apples, there were found at Robenhausen a considerable number of a larger kind, which probably were a cultivated variety. Pears must have been less common, for only a few specimens have been found at Wangen and Robenhausen. The fruits of the service-tree have also been found at Wangen and Robenhausen, stones of the cherry—in fact of the sweet cherry—only at the latter settlement. The plum (Robenhausen) is the nearest to the bullace (*Prunus institia avenaria*, Fab.) Sloes were gathered by the colonists, and also bird cherries (*Prunus padus*, L.) in great abundance. Stones of the perfumed cherry (*Prunus Mahaleb*, L.) have been found at Robenhausen and Parma. Grape-stones are found at Castione,

near Parma. Raspberry, blackberry, and strawberry seeds are found, the latter the rarest of the three. The seeds of the dog-rose, the common elder, and the dwarf elder, are met with in abundance. On the other hand the seeds of the bilberry are rare, and the red whortleberry or cowberry does not appear to have been eaten, for only its leaves are found. Stones of the cornel-cherry are met with abundantly at Castione, and the berries of the wayfaring tree occur in several lake dwellings.

FIG. 42.



Figs. 1 to 4, crab; *a*, *b*, core and seed; *c*, stalk. Figs. 5 and 6, cultivated apple. Fig. 7, wild pear. Fig. 8, *a*, strawberry seed magnified; *b*, water crowfoot magnified. Fig. 9, raspberry seed magnified 4 diameters. Fig. 10, seed of the blackberry magnified. Fig. 11, grape-stones, *a*, *b*, natural size; *c*, magnified. Fig. 12, stone of the cornel-cherry. Fig. 13, perfumed cherry (*Prunus Mahaleb*); *a*, *b*, from Castione, near Parma; *c*, *d*, from Robenhausen. Fig. 14, bird cherry (*Prunus Padus*); *a*, *b*, round stone from Robenhausen; *c*, rather a long stone, from Concise. Fig. 15, sloe stone. Fig. 16, plum stone; *a*, furrowed ventral side; *b*, broad side; *c*, dorsal furrow. Figs. 17 and 18, cherry stones.

5. *Nuts.*—Beech-nuts are found abundantly; they were probably used as food, and perhaps oil was pressed from them. The walnut was met with at Parma. The water-chestnut (*Trapa natans*, L.) which now only exists in Switzerland in a tarn in the canton of Lucerne, but which is found both at Robenhausen and Moosseedorf, formed doubtless an article of food, as it does at the present day in Upper Italy.

6. *Oil-producing plants.*—A whole cake of the seeds of the garden or opium poppy was found at Robenhausen; probably

these seeds were pressed for oil, or they may have been eaten, scattered over the bread.

7. *Aromatic plants.*—The caraway seeds found at Robenhausen were probably used as condiments for food.

8. *Bast and fibrous plants.*—The flax of the lake dwellings is not the common flax. The small-leaved flax (*Linum angustifolium*, Huds.) which is a native of the countries of the Mediterranean, from Greece and Dalmatia to the Pyrenees, may be considered as the original stock of the cultivated flax of the lake dwellings. The presence of the Cretan catchfly proves that the colonists got their flax-seed from Southern Europe. A little flat slab consisting of flax-seed, wholly or partially burnt, was found at Robenhausen: possibly it may have been a kind of linseed cake, intended to be eaten by the colonists.

9. *Plants used for dyeing.*—The weld (*Reseda luteola*) may probably have been used for dyeing the linen cloth.

10. *Forest trees and shrubs.*—No great change appears to have taken place in the forest flora since the age of the lake dwellings. It is worth mentioning that at Robenhausen there were found portions of twigs and remains of the leaves of the mistletoe (*Viscum album*), the sacred plant of the Gauls.

11. *Mosses and ferns.*—Moss was undoubtedly used for stopping the holes in the walls of the huts, and also for bedding.

12. *Fungi.*—The common tinder fungus (*Feuerschwamm*), which occurs in nearly all the lake dwellings, was probably used for procuring fire.

13. *Water and marsh plants.*—The character of these remains shows us that, at least at Robenhausen, the lake dwellings did not stand on the deep clear lake-bottom, but on muddy shallows overgrown with vegetation; and also that the growth of peat had already begun on the shore.

RESULTS OF THE INVESTIGATION OF THE LAKE-DWELLING PLANTS.

1. The inhabitants of the lake dwellings do not appear to have had any close connection with the people of Eastern Europe, for they, at least in the bronze age, cultivated rye, with which the lake settlers must have become acquainted if there had been any mutual intercourse. On the contrary, all the cultivated plants show a connection with the countries of the Mediterranean. Every kind of corn came to them from that

quarter. We have seen that the lake colonists cultivated not only the same barley, but even the same variety, as the inhabitants of Southern Italy. According to Pickering, barley appears on the monuments of the Pharaohs of the earliest age, and is found most abundantly in the mummy-cases. We have further seen that a kind of wheat, which still is very commonly cultivated in Egypt, and yet is found in very ancient mummy-cases, came, at least occasionally, into our districts. The Indian millets have also very probably been introduced in the same manner; they were much cultivated in Egypt, and the *Setaria* (*Fennich*) is represented on a tomb of Rameses Sethos, and at El-Kab.

The lake colonists had therefore the same cereals as the Egyptians. They were also clothed in the same manner, for in Egypt flax took the first place amongst the plants used for spinning and weaving. All the mummies are wrapped in linen cloth, and in the time of Herodotus the priest could wear only linen garments. One of the plagues sent by Jehovah upon Egypt was the destruction of their crops of flax and barley by thunder and hail (Exodus ix. 31). The cultivation of flax, and the art of weaving the thread, may frequently be seen on the Egyptian mural paintings,[1] while hemp was unknown as a plant for making thread, and it is also entirely unknown in the remains of the lake dwellings. The garden or opium poppy is, indeed, nowhere drawn on the Egyptian monuments, but, on the other hand, it appears, together with the ear of barley, on a very ancient coin of Smyrna, and also on one of Metapontum; and this plant must have been of some considerable importance amongst the lake colonists, as they probably procured oil from its seeds.

Now, if we take into consideration all these cultivated plants brought into our districts by man out of the far East; and if we further consider the weeds which, contrary to his inclination, came with them, and of which some (especially the *Centaurea cyanus* and the *Silene Cretica*) also indicate a southern origin, we can hardly hesitate to assert that this agricultural knowledge came into our districts from the basin of the Mediterranean, and that the problematical appearance of celts of nephrite in our lake settlements may have to rank amongst a great number of similar phenomena. The presence of what is called noble nephrite, which is only known in the East, is not more strange than the appearance of the Egyptian wheat, the Cretan catchfly, the oil-yielding poppy, and the glass beads found at Wauwyl, which were either of Egyptian or Phœnician origin. When we speak of Egypt, as we again and again have had occasion to do, we naturally are not thinking of a direct intercourse between the lake colonists and this country; but we simply mean to state that it was the home of that civilisation which spread so widely amongst the regions of antiquity, and which had probably extended over the shores of the Mediterranean from Egypt and Phœnicia, and had been transmitted further inland from their colonies, so that from these original centres of the civilisation of that age, some scattered rays may have reached even to our lake dwellings.

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[1] Sir Gardner Wilkinson's *Manners and Customs of the Ancient Egyptians*, iii. pp. 134, 135, and 138.

2. If this supposition be correct, we may obtain some indication, to aid us in determining the age of the lake dwellings. Even if we were ignorant of the absence of metals in the older settlements, we should be obliged from the character of their plants to ascribe to them a very great antiquity. The non-existence of winter corn, of most of the culinary vegetables, and of hemp, as also of the domestic fowl, indicates a period reaching back long before the Christian era. The Greeks and the Romans had winter corn, cultivated hemp, and had a great variety of culinary vegetables. The domestic fowl is nowhere mentioned in Homer or Hesiod, but in the time of Pericles it is spoken of as the Persian bird, and it appears in Italy on coins of Neapolis, probably struck about a hundred years before Christ. To this it must be added, that the Roman authors never mention a word about lake dwellings, and Professor Desor justly reminds us that Pliny had his villa exactly in the place where there are numerous remains of pile dwellings, but which had so completely vanished from the memory of the people that they appeared to have had no suspicion of these ancient inhabitants of the land. On the other hand, according to my judgment, it is going too far, to estimate the age of the lake dwellings at six or seven thousand years—a view taken by M. Morlot. The great number of varieties of corn, which we find even in the stone age, the general cultivation of flax, and all the industrial arts connected with it, and the degree of civilisation attained by the colonists, as exhibited in their remains, have already led us to the conclusion that a long period must have been required for the development of their abilities.

If we look back three thousand years ago, perhaps in the time of Homer or David, we shall find the same cultivated plants in the East. Barley and wheat are often mentioned in Homer, as well as field beans and poppies, but no mention is made of rye [1] or of oats. In the book of Ruth, which probably was written in David's time, as it relates to a family history of the royal house, barley and wheat are frequently spoken of; and the reapers of Boaz let Ruth have some of their master's parched corn. Consequently, barley and wheat were the chief kinds of corn in Palestine eleven hundred years before Christ. But they are mentioned, together with spelt, a good deal earlier, viz., in Genesis, as having undoubtedly in much earlier time laid the foundation of the civilisation which then existed in Egypt.

In David's time (2 Samuel xvii. 28) beans and lentils are spoken of as common food. And the spelt is mentioned elsewhere; but nothing is said of rye or of oats. Together with these, we have the kinds of wheat and leguminous plants which have been found in the lake dwellings of Western Switzerland, belonging to the bronze age. At that time bronze appears to have been the metal most generally in use amongst the Orientals and the Greeks. And it is mentioned everywhere in Homer. Bearing in mind the very slow diffusion of civilisation in those ages, the supposition may probably not appear too hazardous, that the lake dwellings where the use of bronze was known may be placed about this period.

But the settlements of the stone age must be earlier; and yet they are so closely connected with those of the bronze age, by such stations as Robenhausen and Meilen, and even the oldest settlements, like Wangen and Moosseedorf, both in cultivated plants and in domestic animals, agree so nearly with the others, that no sharp line can be drawn between them, and they cannot probably be thrown back many thousand years further.

3. The lake dwellings were inhabited during the whole year, and the cattle were stalled upon them. The manure which was found at Robenhausen proves the latter proposition, and the

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[1] The English version of Exodus ix. 31, 32, seems to contradict this as far as Egypt is concerned, but from the best authorities, the original word here rendered 'rye' should be translated 'spelt,' as given in the Zürich Bible, and in that of De Wette. Professor Heer states that rye has never been found in the Egyptian monuments, and that the English translation is evidently incorrect, for rye comes *before* wheat, and wheat and spelt also ripen *after* barley. Rye in the Mediterranean countries is cultivated at the present day merely as green food, not as a cereal. Professor Heer adds that 'spelt was actually cultivated in Egypt in the time of the Pharaohs, as is evident from some grains I have received from Professor Ehrenberg, which date from that period.'

undigested remains of food prove the former. The cherry-stones with great probability indicate the month of June; the seeds of raspberries and blackberries the middle and end of summer; the sloes and the seeds of the dog-rose speak of the latter part of autumn or the beginning of winter, when these fruits first become eatable after they have been exposed to the frost; while the hazel-nuts and beech-nuts have reference to autumn and winter: as well as the seeds of weeds grown with the corn and separated from it by the colonists and then thrown into the lake.

4. From Professor Rütimeyer's investigation as to the fauna of the lake dwellings, it appears that at the time of the older settlements of the stone age the wild animals used as food far preponderated over the domestic animals; and that the chase afforded more flesh to the colonists than their herds. But these proportions underwent a change in the bronze age, very favourable to the domestic animals. The great wild oxen, the Urus and the Bison, disappeared, and a great number of new races of horned cattle came upon the scene. (See Rütimeyer's *Fauna der Pfahlbauten*, p. 236.) With respect to plants also, there appears to have been an increase of the cultivated kinds, but even in the oldest known settlements, such as Moosseedorf and Wangen, we found various kinds of corn cultivated, as well as flax, consequently there must have been a knowledge of agriculture. In Robenhausen we have proof of the cultivation of fruit, and in the age of bronze, that of leguminous plants. However much the wild fruits may have been eaten, yet, from the very first, cultivated plants seem to have afforded the most important articles of vegetable food.

5. Although the actual determination of the age of the lake dwellings is doubtful, yet we may say with perfect certainty that they are more than 2,000 years old; and, with a considerable amount of probability, that they reach back from 1,000 to 2,000 years before Christ. In any case the remains of plants have a very high antiquity, and they throw some light on the solution of the question, whether the species of plants have undergone any change in historic time. With respect to the wild plants, the question must be answered in the negative. The most careful investigation of them shows a surprising agreement with the recent species, and even small varieties of form have been retained, as we see in the water-lily, the fir, the sloe, the bird cherry, and the hazel-nut. Professor Unger has come to the same result by investigating the Egyptian

plants. But the case is different with the cultivated plants, although some kinds—as the dense compact wheat (*Binkelweizen*) and the close six-rowed barley—have undergone no perceptible change, yet it must be confessed that most of them agree with no recent forms sufficiently to allow of their being classed together. The small Celtic beans, the peas, the small lake-dwelling barley, the Egyptian and the small lake-dwelling wheat, and the two-rowed wheat or *Emmer*, form peculiar, and apparently extinct, races: they are distinguished for the most part from the modern cultivated kinds by smaller seeds. Man has, therefore, in course of time produced sorts which give a more abundant yield, and these have gradually supplanted the old varieties.

We have, therefore, to consider the latter as the original stock from which the others have sprung. Thus, probably, the small six-rowed barley of the lake dwellings is the original form from which the four-rowed barley has descended. The axes of the ears have become longer by cultivation, the spikelets are pushed further asunder, and therefore the longitudinal rows lie one over the other. We thus find only four rows on the ears, and the form becomes what is known as common barley (*H. vulgare*). But there was also a change in another direction. In the side florets the pistils do not come to perfection, and consequently only the middle grains are productive. Thus we get only two rows of grains, which consequently become larger. And so by the lengthening of the axes of the ears we get the two-rowed barley (*H. distichum*, L.), but by the shorter axes the 'rice barley' (*H. Zeocriton*, L.). I consider, however, all these forms of barley only as varieties (*Racen*) of one species; in fact, they sometimes exhibit a transition from one to another.

The same thing occurs with the different kinds of wheat. I consider the small lake-dwelling wheat as the primitive form from which have sprung, by cultivation, the different forms, with the axes not fragile and with the grains easily detached, as they all are very near to each other in character, and no important and decisively distinctive marks are to be found between them.[1]

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[1] The following is the manner in which we should place them: *Triticum vulgare*, Vill. Four-rowed ears, spikelets with 2—4 grains falling out when ripe. Axes not fragile.

a. Triticum antiquorum, M.: Small lake-dwelling wheat. Ears awnless, short, the grains very much rounded, small, and closely pressed together; spikelets with

The flora of the lake dwellings consequently announces to us that all the plants which come in contact with man (*welche des Menschen Hand berührt*) become changed *up to a certain point*, and thus man participates in the great transformations (*Umbildungsprozesse*) of nature, while the wild plants which surround us at the present day still grow in the same forms (*in denselben Formen sich bewegen*) as they did three or four thousand years ago, and do not exhibit the smallest change.

CATALOGUE OF PLANTS.

1. CEREALS.—Small lake-dwelling barley (*Hordeum hexastichum sanctum*). Compact six-rowed barley (*Hordeum hexastichum densum*). Two-rowed barley (*Hordeum distichum*, L.). Small lake-dwelling wheat (*Triticum vulgare antiquorum*, M.). 'Binkelweizen' or beardless compact wheat (*Triticum vulgare compactum muticum*). Egyptian wheat (*Triticum turgidum*, L.). Spelt (*Triticum Spelta*, L.). 'Emmer,' or two-grained wheat (*Triticum dicoccum*, Schrank). One-grained wheat, or 'Einkorn' (*Triticum monococcum*, L.). Rye (*Secale cereale*, L.). Oat (*Avena sativa*, L.). Millet (*Panicum miliaceum*, L.). Italian setaria, 'Kolbenhirse,' or 'Fennich' (*Setaria Italica*, L. sp.).

2. WEEDS OF THE CORN-FIELD.—Darnel (*Lolium temulentum*, L.). White goosefoot (*Chenopodium album*, L.). Many-seeded goosefoot (*Chenopodium polyspermum*, L.). Red goosefoot (*Chenopodium rubrum*, L.). Striped-seeded goosefoot (*Chenopodium*, sp.)[1] Burdock (*Lappa major*, L.). Corn cockle (*Agrostemma Githago*, L.). White campion (*Lychnis vespertina*, L.). Cretan catchfly (*Silene Cretica*, L.). Chickweed (*Stellaria media*, L. sp.). Smooth-seeded spurry (*Spergula pentandra*, L.). Thyme-leaved sandwort (*Arenaria serpyllifolia*, L.). Goosegrass (*Galium apa-*

3—4 ripe grains. Palea, sharply carinated on the back from the very bottom, shorter than the glume, and ending in a small tooth.

b. Tr. sativum, Lam.: Common wheat. Ears either with or without awns, spikelets with 2—3 ripe grains. Palea nearly of the length of the glume, carinated only in front. Grains, a long oval, blunt.

c. Tr. durum, Desf.: Hard wheat. Ears awned; spikelets with 3—4 grains. Palea narrow, as long as the glume; sharply carinated from the bottom, ending in a broad curved tooth.

d. Tr. turgidum, L.: Egyptian wheat. Ears awned; spikelets with 2—3 grains. Palea inflated, broad, shorter than the glume, sharply carinated on the back, ending in a short tooth; grains large, much rounded, ovate.

These 'races' again are subdivided into numerous sub-races.

[1] This seed is drawn Plate CXLI. fig. 41. From Professor Heer's account it seems almost peculiar to the lake dwellings. Under the microscope there are numerous radiating bands, or stripes, very close together, and partially interrupted.

rine, L.). Creeping crowfoot (*Ranunculus repens*, L.). Little bur medick (*Medicago minima*, L.). Corn bluebottle (*Centaurea Cyanus*, L.).

3. Culinary Vegetables.—Parsnip (*Pastinaca sativa*, L.). Common carrot (*Daucus Carota*, L.). Celtic fieldbean (*Faba vulgaris*, Mch.; *Celtica nana*). Pea (*Pisum sativum*, L. var.). Lentil (*Ervum lens*, L.).

4. Fruit and Berries.—Apple (*Pyrus malus*, L.); *a*, smaller crab; *b*, larger round lake-dwelling apple. Pear (*Pyrus communis*, L.). Service-tree (*Pyrus Aria*, L.). Cherry (*Prunus avium*, L.). Bullace (*Prunus institia*, L.). Sloe (*Prunus spinosa*, L.). Bird cherry (*Prunus padus*, L.). Perfumed cherry (*Prunus Mahaleb*, L.). Vine[1] (*Vitis vinifera*, C.). Raspberry (*Rubus idæus*, L.). Bramble (*Rubus fruticosus*, L.). Strawberry (*Fragaria vesca*, L.). Dog-rose (*Rosa canina*, L.). Common elder (*Sambucus nigra*, L.). Dwarf elder (*Sambucus Ebulus*, L.). Bilberry (*Vaccinium myrtillus*, L.). Red whortleberry or cowberry (*Vaccinium vitis—idæa*, L.). Cornel-cherry (*Cornus mas*, L.). Wayfaring tree (*Viburnum Lantana*, L.).

5. Nuts.—Hazel-nut (*Corylus avellana*, L.). Beech (*Fagus sylvatica*, L.). Walnut (*Juglans regia*, L.). Water chestnut (*Trapa natans*, L.).

6. Oil-producing Plants.—Opium or garden poppy (*Papaver somniferum*, L., var. *antiquum*). Dogwood (*Cornus sanguinea*, L.).[2]

7. Aromatic Plants.—Caraway (*Carum Carui*, L.).

8. Bast and Fibrous Plants.—Flax (*Linum angustifolium*, Huds.). Lime-tree (*Tilia grandifolia*, Ehrh.). Small-leaved lime-tree (*Tilia parvifolia*, Ehrh.).

9. Plants used for dyeing.—Weld (*Reseda luteola*, L.).

10. Forest Trees and Shrubs.—Scotch fir (*Pinus sylvestris*, L.). Mountain pine (*Pinus montana*, Mill.). Spruce fir (*Pinus abies*, L.). Silver fir (*Pinus picea*, L.). Juniper (*Juniperus communis*, L.). Yew (*Taxus baccata*, L.). Oak (*Quercus robur*, L.). Hornbeam (*Carpinus betulus*, L.). Alder (*Alnus glutinosa*, L.). Birch (*Betula alba*, L.). Willows (*Salix repens* and *Salix cinerea*). Ash (*Fraxinus excelsior*, L.). Mistletoe (*Viscum album*, L.). Holly (*Ilex aquifolium*, L.). Spindle-tree (*Euonymus*

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[1] Professor Heer looks on the grape-stones from Wangen with suspicion, because they are like those of the modern grapes, and they are not burnt; but this is also the case with the seeds of the bramble and the strawberry. The grape-stones from Castione he considers genuine, as they agree with those of the wild blue grape.

[2] The kernels of dogwood seeds contain a rich oil, which may be pressed out.

Europæus, L.). Berry-bearing alder (*Rhamnus frangula*, L.) Maple (*Acer*, sp.). Mountain ash (*Sorbus aucuparia*, L.).

11. Mosses and Ferns.—Mosses: *Antitrichia curtipendula*, Dill. sp.; *Neckera complanata* and *N. crispa*, Dill.; *Thuidium delicatulum*, L. sp.; *Anomodon viticulosus*, Dill.; *Leucodon sciuroides*, Dill.; *Hylocomium brevirostre*, Ehrh. Fern: *Pteris aquilina*, L.

12. Plants for procuring Fire.—Common tinder fungus (*Polyporus igniarius*, L.); *Polyporus fomentarius*, L. Oak agaric (*Dædalia quercina*, L.).

13. Water and Marsh Plants.—Chara (*Chara vulgaris*, L.; *Ch. fœtida*, A. Br.). Common reed (*Phragmites communis*, L.). Lake scirpus (*Scirpus lacustris*, L.). Sedges (*Carices*). Marsh Scheuchzeria (*Scheuchzeria palustris*, L.). Yellow flag (*Iris pseudacorus*, L.). The pondweeds (*Potamogeton perfoliatus*, L.; *P. compressus*; *P. natans*, L.; *P. fluitans*, Roth.). Common hornwort (*Ceratophyllum demersum*, L.). Water plantain (*Alisma plantago*, L.). Water pepper (*Polygonum hydropiper*, L.). Marsh bedstraw (*Galium palustre*, L.). Buckbean (*Menyanthes trifoliata*, L.). Marsh lousewort (*Pedicularis palustris*, L.). Marsh pennywort (*Hydrocotyle vulgaris*, L.). Hog's fennel (*Peucedanum palustre*, L.). White water-lily (*Nymphæa alba*, L.). Yellow water-lilies (*Nuphar luteum* and *N. pumilum*?). Watercrowfoot (*Ranunculus aquatilis*, L.; *R. hederaceus*, L.; *R. flammula*, L.; *R. lingua*, L.).

EXPLANATION OF THE FIGURES IN PLATES CXLI. AND CXLII.

N.B.—Figs. 1 to 44 are on the First; Figs. 45 to 108 on the Second Plate.

Figs. 1–8, small lake-dwelling barley (*Hordeum hexastichum sanctum*). Figs. 1, 2, 3, ears from Robenhausen. Figs. 2 and 3 are placed so that the three grains may be seen which stand in one of the hollows of the axis. The three rows of grains, therefore, here seen, belong to one side of the axis, while the other side with its three rows lies behind. Fig. 1 is the drawing of an ear (perfect as far as the length is concerned), given in a different view, for the first and second row, reckoning from the left, belong to two sides of the ear, and in the upper, or most perfect portion, four rows may be seen. Fig. 4, single grains; *a* and *d* from the outside, with the germ; *b*, *c*, from the inside. Fig. 5, from Wangen. Fig. 6, *a*, *b*, *e*, *f*, from Peter's Island; *c*, *d*, from Montellier. Fig. 7, grain surrounded by both the glumes. Fig. 8, axis from which most of the grains have fallen off; it shows the places where the spikelets join on to it, and also how closely they are arranged. Fig. 9, compact six-rowed barley (*Hordeum hexastichum densum*). Fig. 9, portion of an ear from Robenhausen. Fig. 9, *b*, *c*, *d*, single grains, both from the front and the back. Figs. 10 to 13, ancient Italian silver coins. The six-rowed barley is excellently delineated on the most ancient coins of Metapontum, about the sixth century B.C., Fig. 10, and still more accurately represented on those of the fifth century B.C., Figs. 11 and 12. On many of these coins a locust (*Acridium migratorium*, L.), is sitting on the ear, while on the reverse is Apollo, the god who protects the barley-field from the dreaded plague of locusts. The coin, Fig. 12, represents the mouse, together with the ear of barley, and on the reverse is Ceres, the protectress of agriculture, with ears of the same kind of barley plaited in her hair.[1] The sparrow also, that constant attendant upon all cereal operations, is not absent; nay, even the destructive wheat-fly (*Cecidomyia destructor*) is quite easily recognised upon the ears of barley. On the coins of Leontinon, Fig. 13, an ancient Sicilian town, only single grains of barley are represented, with the lion's head; they agree with those of the small lake-dwelling barley, the ancient type of the sacred barley. Figs. 14-18, small lake-dwelling wheat (*Triticum vulgare antiquorum*, M.). Fig. 14, portion of an ear from Robenhausen. Fig. 15, a second portion seen from the inside, showing the close arrangement of the spikelets. Fig. 16, a single spikelet with four grains. Fig. 16 (below), glume, very much magnified. Fig. 17, the ear completed. Fig. 18, single grains; *a*, *b*, *c*, *e*, *f*, *g*, from Robenhausen; *aa*, from Moosseedorf; *d* from Montellier; *h* from Olmütz. Fig. 19, 'Binkelweizen,' or beardless compact wheat (*Triticum vulgare compactum muticum*); 19, *a*, spikelet with three grains; *b*, *c*, from Robenhausen; *f*, out of a piece of bread; *d*, *e*, from Buchs; *g*, *h*, from Peter's Island; *i*, from Parma. Fig. 20, Egyptian wheat (*Triticum turgidum*, L.), whole ear from Robenhausen. Fig. 21, grains from this ear; *a*, front; *b*, back with the germ; *c*, section; *d*, glume. Fig. 22, spelt (*Triticum spelta*, L.), from Peter's Island; *a*, spikelet, with the glume; *b*, *c*, *d*, *e*, grains. Fig. 23, lake-dwelling 'Emmer' (*Triticum dicoccum*, Schrank), from Wangen, whole ear; 23, *b*, side view of a portion of it. Fig. 24, Oat (*Avena sativa*, L.). Fig. 24, *a*, *b*, from Buchs; *c*, from Montellier; *d*, *e*, from Peter's Island; *f*, from Wismar, in Mecklenburg. Fig. 25, rye (*Secale cereale*, L.), from Olmütz; *b*, *c*, back view with the germ; *a*, front; *d*, section. Fig. 26, millet (*Panicum miliaceum*, L.), from Wangen; *b*, glume magnified. Fig. 27, *a*, *b*, *c*, single grains from Montellier magnified. Fig. 28, Italian setaria (*Setaria Italica*, L.), from Montellier. Fig. 29, two grains magnified: *a*, *b*, from Buchs. Fig. 30, Cretan catchfly (*Silene Cretica*, L.) capsule, from Robenhausen. Fig. 31, seeds of this plant from the same place; *a*, magnified; *b*, back of the seed; *c*, some of the little projections very much magnified. Fig. 32, corn-cockle (*Agrostemma githago*, L.), from Robenhausen. Fig. 33, white campion (*Lychnis vespertina*, L.), magnified two diameters, from Robenhausen. Fig. 34, Sandwort (*Arenaria serpyllifolia*, L.), magnified, from Moosseedorf. Fig. 35, goosegrass (*Galium aparine*, L.); from Montellier. Fig. 36, burdock (*Lappa major*, L.), *a*, *b*, from Robenhausen. Fig. 37, corn bluebottle (*Centaurea cyanus*, L.), from Robenhausen, magnified. Fig. 38, spurry (*Spergula pentandra*, L.), from Robenhausen, magnified. Fig. 39, creeping crowfoot (*Ranunculus repens*, L.), magnified two diameters. Fig. 40, white goosefoot (*Chenopodium album*, L.); *a*, natural size; *b*, *c*, magnified; *d*, still further magnified; *e*, back view. Fig. 41, striped-seeded goosefoot; *a*, magnified three diameters; *b*, very much magnified. Fig. 42, darnel (*Lolium temulentum*, L.); *a*, *b*, natural size; *c*, magnified. Fig. 43, parsnep, (*Pastinaca sativa*, L.); *a*, outside of the seed; *b*, magnified three diameters; *c*, inside magnified; from Moosseedorf. Fig. 44, Celtic field-bean (*Faba vulgaris Celtica*, M.), from Montellier. Figs. 45, 46, from Peter's Island. Fig. 47, from Castione, near Parma. Fig. 48, pea (*Pisum sativum*, L. var.), from Peter's Island. Fig. 49, lentil (*Ervum lens*, L.); *c*, back view, Peter's Island. Fig. 50, service-tree (*Pyrus aria*, L.), seed from Robenhausen. Fig. 51, dog-rose (*Rosa canina*, L.), seed magnified, from Robenhausen. Fig. 52, elder (*Sambucus nigra*, L.), seed magnified, from Robenhausen. Fig. 53, dwarf elder (*Sambucus ebulus*, L.), seed, magnified two diameters, from Robenhausen. Fig. 54, bilberry (*Vaccinium myrtillus*, L.), seed magnified, from Robenhausen. Fig. 55, wayfaring-tree (*Viburnum lantana*, L.), from Robenhausen. Figs. 56-60, Hazel-nut (*Corylus avellana*, L.).

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[1] Even in these small ears, as well as those equally small upon the Campanian coins (together with the horse's head), the artist knew how to give the character of the sacred barley, while on modern coins, such as those of the French Republic of 1848, no mortal can say whether the ears are intended to represent those of barley, or wheat, or rye.

Fig. 56 (*C. avellana*, L.), and Fig. 57 (*C. avellana ovata*, W.), bored by the nut-beetle, from Robenhausen. Fig. 58, from Parma. Fig. 59, double or chance nut. Fig. 60, nut bitten by a mouse, from Moosseedorf. Fig. 61, leaf, from Moosseedorf. Fig. 62, beech-nut (*Fagus sylvatica*, L.), from Moosseedorf. Fig. 63, covering of the beech-nut, from Robenhausen. Fig. 64, water chestnut (*Trapa natans*, L.), from Robenhausen. Fig. 65, garden or opium poppy, young heads or seed vessels, charred, from Robenhausen; *a*, upper view; *b*, side view. Fig. 66, seeds; *a* (natural size), a small piece of the poppy cake; *b*, poppy seed, magnified four diameters, from Robenhausen. Fig. 67, dogwood (*Cornus sanguinea*, L.); *a*, nut or seed; *b*, section; from Robenhausen. Figs. 68–77, lake-dwelling flax (*Linum angustifolium*, Huds.) Figs. 68–71, burnt capsules; 69 from below, 68 from above. Figs. 70–71, side view. Fig. 72, unburnt capsule, from Robenhausen. Fig. 73, seeds out of this capsule; *b*, magnified. Fig. 74, unburnt seed, from Moosseedorf; *a*, *b*, natural size; *c*, magnified two diameters. Fig. 76, portion of a linseed cake, from Robenhausen. Fig. 77, stalk of the flax plant; *a*, lower part; *c*, *d*, upper part, showing the places of attachment of the smaller branches; *e*, *f*, with thin twigs, to which probably the capsules were attached. Figs. 78–80, fruit of the lime tree. Fig. 78, with four carpels. Fig. 79, with five. Fig. 80, the five carpels split open, all of the *Tilia parvifolia*, Ehrh. Fig. 81, weld (*Reseda luteola*, L.), very much magnified; Robenhausen. Fig. 82, Scotch fir (*Pinus sylvestris*, var.); *b*, single scale, side view, from Robenhausen. Fig. 83, mountain pine (*P. montana*, Mill.), from Robenhausen; *c*, scale, side view; *b*, seed, from Robenhausen. Fig. 84, silver fir (*Pinus picea*, L.); *a*, *b*, needle-shaped leaves, from Robenhausen. Fig. 85, juniper (*Juniperus communis*, L.), cone, from Robenhausen. Fig. 86, yew (*Taxus baccata*, L.); *a*, *b*, seed, natural size; *c*, magnified; from Robenhausen. Figs. 87–90, oak (*Quercus robur*, L.). Fig. 87, acorn cup, from Robenhausen. Figs. 88, 89, burnt acorns, from Peter's Island. Fig. 90, burnt acorn, from Parma. Fig. 91, hornbeam (*Carpinus betulus*, L.), seed, seen from the front and the back, *a*, *b*. Fig. 92, mistletoe (*Viscum album* L.), portion of a branch, Moosseedorf. Fig. 93, lake scirpus (*Scirpus lacustris*, L.), from Robenhausen; magnified. Fig. 94 (*Potamogeton perfoliatus*, L.), from Robenhausen; magnified. Fig. 95 (*P. compressus*, L.), from Robenhausen. Fig. 96, common hornwort (*Ceratophyllum demersum*, L.), from Robenhausen. Fig. 97, marsh bed-straw (*Galium* *palustre*, L.); *a*, natural size; *b*, *c*, magnified. Fig 98, very much magnified; from Robenhausen. Fig. 99, buckbean (*Menyanthes trifoliata*, L.); *a*, *b*, *c*, slightly magnified; Robenhausen. Fig. 100, marsh lousewort (*Pedicularis palustris*, L.), seed, magnified. Fig. 101, yellow water-lily (*Nuphar luteum*, L.), Robenhausen. Fig. 102, small yellow water-lily (*Nuphar pumilum*, Sm.); *c*, from above, magnified; Robenhausen. Fig. 103, white water-lily (*Nymphæa alba oocarpa*), magnified two diameters; Robenhausen. Fig. 104, white water-lily with small seeds; magnified two diameters; Robenhausen. Fig. 105 (*Scheuchzeria palustris*, L.), magnified two diameters; Robenhausen. Fig. 106, lesser spearwort (*Ranunculus flammula*, L.), magnified three diameters. Fig. 107, ivy-leaved crowfoot (*Ranunculus hederaceus*, L.), magnified; Robenhausen. Fig. 108, marsh pennywort (*Hydrocotyle vulgaris*, L.), magnified two diameters; Robenhausen.

RESULTS OF THE INVESTIGATION OF ANIMAL REMAINS FROM THE LAKE DWELLINGS.

By Professor Rütimeyer, of Basle.

The results of my earlier labours have in their essential parts been quite confirmed, and in many points completed, by the investigations lately carried on; and besides this, some quite new and interesting species of animals have been discovered. The chief point, however, was more especially to follow out the fauna of the lake dwellings in a descending line, in order to ascertain its relation to the fauna of the present day; and in this retrospective view the domestic animals seemed of the first importance, the historical changes in the department of wild animals being of a far simpler nature.

All these results are the objects of an especial work, illustrated with drawings, and which gives the existing state of our knowledge as to the wild and domesticated animals of the lake dwellings, as well as the changes they have undergone in the course of time up to the present day.[1] I will, however, in this short report, gladly refer to one or two points in this work which may be interesting not only to the zoologist, but also to the antiquary.

It was to be expected that the animals of less size—the birds, the fishes, and the smaller mammalia—would form the chief additional contribution to our earlier list of animals. With respect to fishes, many species were found which are now the most abundant in our lakes and rivers, and also a large number of birds which would form just such a flock as may be seen at the present day in the wild and well-wooded marshy places of our own country. To the birds of prey already known to have been common, as well as the herons and ducks, we may now add the golden eagle, the osprey, the stork and the swan, the wild goose, the gull, the black water-hen or coot, and the black cock. The presence of the swan, which only appears on our lakes in very cold winters, in the months of December and January, is peculiarly interesting, as it proves that the lake dwellings were not abandoned in the most severe winter weather, when even our larger lakes are often frozen over for a length of time.

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[1] Die Fauna der Pfahlbauten in der Schweiz, Untersuchungen über die Geschichte der wilden und Haus-Säugethiere Mitteleuropas. Mit Holzschnitten und 6 Tafeln Abbildungen. Basel, 1861.

Not a single trace of the domestic fowl has yet been found amongst the lake dwellings; one single bit of bone of the common hen found at Morges hardly deserves to be mentioned, as it was found in an open lake, and, besides this, had a very suspicious appearance.

The little animals which are so inconvenient in our modern houses, rats and mice, do not seem to have troubled the inhabitants of the lake dwellings, so that they could the more easily do without cats, of which no remains whatever are found. The only bone of a mouse yet found belongs to the field-mouse, which never lives in houses. For the first time, we find at Moosseedorf and Robenhausen traces of the hare.

The late additions to the list of great mammalia are naturally smaller in number. Amongst them, however, are the ibex and the chamois, and two domestic animals, viz. the ass, and at Concise and Chevroux a very large ox with great semilunar horns bent forwards from the frontal plane: this animal has hitherto only been known in a fossil condition in the diluvium of Italy, and was contemporaneous with the mammoth and the hippopotamus. At Concise and Chevroux this ox with curved horns can positively be proved to have been domesticated; it was nearly as large as the urus.

The last-named animal as well as the bison (or wisent) were at first considered as rather rare, but now they are found to have been the most abundant animals in the forest of the stone age; we ought, however, to state that at Concise they entirely disappeared with the introduction of metal weapons. From this time forward in general, all game or wild animals which in early ages far preponderated in number over the domestic animals, began to decline in a most marked manner, and became of second-rate importance. From several specimens, the urus is now proved to have existed not only at Moosseedorf and Robenhausen, but also at Wauwyl and Concise: at Robenhausen there were a number of specimens. I only as yet know of the bison at Wauwyl and Robenhausen, but at the latter place there are at least half a dozen specimens of different ages.

Though the urus became extinct at an early period, together with the aurochs or bison—for we will not assume that it gradually withdrew out of Switzerland to its present abodes—yet it has left abundance of traces behind it. One of the most important and surest results of the investigations, as far as they have gone, consists in showing that the urus lived in Switzerland in the stone age, both in a wild state and also as a domestic animal which had been long tamed. We cannot venture to conclude that it was first domesticated at this period, for at Moosseedorf and Robenhausen it had already, like the *Bos trochoceros*, just referred to from the lake of Neuchâtel, lost much of the size of its wild ancestors and contemporaries, either by crossing with a smaller breed, or, what is more probable, by scanty food, for we find that the same domestic cattle, when well fed, again attain at the present day to the giant size of their ancestors, who are far removed from them in time. It is remarkable, however, that this domestic animal is no longer found in Switzerland, but only on the marshes of the coasts of the North Sea. No trace of *Bos trochoceros* can be found amongst our present races of cattle.

One race we have already, on sure grounds, named the 'marsh cow.' With those just mentioned it completes the series. It lived in the stone age, was most abundant in the older settlements, and has lasted up to the present day in the greater part of Switzerland. It is allied to what is called at the present day the brown cow, which almost exclusively occupies the whole mountainous part of Switzerland, and in many wild mountain valleys does not exceed the size of the small race from which it has sprung. This race of cattle seems to warrant an assumption as to the colour of the marsh cow of the stone age.

The pig is another domestic animal of which several races were found very early. Yet, as far as I can make out, it did not occur tame in the oldest settlements of the stone age; but, on the contrary, there were then two races of wild swine, which might almost be called species—one the wild boar of the present day, and the other what I have designated as the marsh swine. I find the first traces of wild swine at Robenhausen, Meilen, and Concise, consequently about the time when metals first came into the possession of the colonists. In fact, the marsh pig was first found in a tame state, and then, still later, at Concise and at the Thièle, the wild boar. A third race is foun at Morges, still smaller than the first, and, from all appearance, partly of foreign origin, like the *Bos trochoceros.*

From this period also the races of dogs and sheep increase, and gradually complete the present series of domestic animals. This is not the place to enter into an exact description of these races, their probable origin, and their representatives at the present day. Half of the work already referred to, 'The Fauna of the Lake Dwellings,' is devoted to this historic sequence of the domestic animals, and enters into the subject as fully as can be done at present; the difficulty of the investigation, however, leaves ample room for completion at some future time.

I will only, in conclusion, refer to two unexpected results, which are remarkable on many accounts. In the first place, I cannot find all through the whole period of lake dwellings one very notable domestic animal which at the present day is of the greatest importance in Switzerland amongst all its contemporaries, and which is of the first economic value. I refer to the great spotted cow (Fleckvieh), as it is called, of Northern and Western Switzerland, coloured black and white or red and white, the purest breeds of which are known under the names of the Freiburg and the Simmenthal-Saanen breeds. The very striking osteological characters of this race, which enable us to trace it back to a peculiar original stock, quite as well as the three other races of domestic cattle of the lake period, leave us without any doubt on the point. This breed is not found during the whole period of the lake dwellings, and first makes its appearance at a very late period, apparently about the time when the great *Primigenius* race of the stone age gradually became extinct in Switzerland, or retreated from that country. One single locality, and that not a lake dwelling, viz., Steckborn, on the lake of Constance, has afforded, together with the last representatives of the earlier epoch, the first traces of this new and most important representative of the present age.

And yet we cannot exactly name the very last representatives of the earlier period, for in that case the brown cow would have been specified, which is spread over such an extent of ground, and which has continued almost unchanged from the earliest times in which we have any traces of civilisation, down to the present day; in fact, this is almost the only inheritance we have received from those early ages. It is only in a most remote corner of our Alps, in the background of the 'Vorder Rhein,' that in a very singular manner we meet with remains of the olden time of a somewhat similar nature, such as the sheep of the stone age, and the last remnant of the marsh swine, though with the characters much obliterated and changed. It is a matter of no small importance that a race of men live in the same districts who, besides using an old dialect which for the most part has disappeared long since from other parts of Switzerland, bear in the shape of their skull the stamp of a much earlier age.

And it is here, in the study of man himself, that doubtless is to be found the key of many of the existing difficulties, and the material for filling up many gaps still left in the investigation of the animal world. The facts to enable us to commence this part of the task are gradually increasing, and we may venture to hope that the anatomical investigation of the human and animal remains will, at no great distance of time, mutually complete and explain each other.

These notices on some of the more essential parts of the results of the late investigations may probably be sufficient for the present volume. I cannot, however, in conclusion, refrain from expressing my conviction that even the oldest lake dwellings do not by any means exhibit to us the primitive population of our country. I must, indeed, regard them as 'autochthones,' or at least as very ancient inhabitants of these districts, for they possessed as domestic animals a number of those which undoubtedly were indigenous here, particularly the urus and the marsh swine; but the fact, that from the beginning they had the sheep and the dog, the indigenous origin of which is, to say the least, highly improbable, indicates their having descended from a still earlier people. For my own part, therefore, I have little doubt of the existence at one time of a genuine primitive population throughout Europe. This appears to have been proved, as far as France is concerned, by the latest discovery in Aurignac.[1]

This seems to be the first place where we can no longer strive against the evidence of a European population who used as food not only the urus and the bison, but also the mammoth and the rhinoceros, and who left the remains of their feasts not only to be gnawed by the wolf and the fox, but also by the tiger and the hyæna. It is, in truth, an old psychological experience, that we always consider that to be really primitive which we see the farthest removed from us, and this in spite of numerous admonitions which are continually pointing out to us stations lying further and still further behind. The investigation of the commencement of human history will hardly have the prerogative of being liberated from the gradual advance which palæontology has followed up. The discovery at Aurignac places the age of our lake dwellings at a comparatively late period, although almost immediately under our peat beds with their rich treasures, similar antiquities are found; nay, still older remains are met with only a little deeper (in the slaty brown-coal of Dürnten, perhaps forty feet under the bed of the lake of Pfaffikon) than those of Aurignac, which have there been gnawed by hyænas, after having been despoiled of their marrow (like the bones of Robenhausen) by human hands. This last fact would also point out to us the place where we have to look for the remains of the ancestors of the lake settlers, namely, *under* the glacier moraines; for it is manifest that the people who inhabited the Grotto of Aurignac were older than the extension of the glaciers, and consequently witnesses of this mighty phenomenon. But this fact, on the other hand, takes from us every hope of still finding traces of human existence on places over which the ancient glaciers have passed. Examples showing this in later times are by no means wanting in our country. At all events the last gap between geological and historical time is now filled up by the discovery at Aurignac.

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[1] See the 'Société Philomathique de Paris.' Extrait de la Séance du 18 mai 1861.

To the above remarks of Professor Rütimeyer it will be well to append a complete list of the animals found in the lake dwellings. To those who have read the previous pages, it will hardly be necessary to remark that the names of many of the localities are given abridged. Thus: Rob. signifies Robenhausen; Mei., Meilen; Moos., Moosseedorf; Wang., Wangen; Wauw., Wauwyl; and Con., Concise. Some slight alterations have been made by Professor Rütimeyer within the last few weeks:—

Ursus arctos	Rob., Mei., Moos., Wang., Con., Neuville.
Meles vulgaris	Rob. *et passim.*
Mustela foina	Rob. and all stations of the stone age.
„ martes	Rob., Wauw., Moos., Mei., Con.
„ putorius	Rob, Wauw., Moos., Con.
„ erminea	Wauw.
Lutra vulgaris	Rob., Moos.
Canis lupus	Rob., Mei., Wang., Wauw., Con., Zihl. (teeth as trophies of the chase: only a few bones).

Canis vulpes	Rob. *et passim.*
„ familiaris	Rob., Mei., Moos., Wauw., Wang., Con., Bienne.
„ fam. major	Only in the Western Lakes.
Felis catus	Rob., Moos., Wauw.
Erinaceus Europæus	Rob., Moos., Wauw.
Castor fiber	Rob. and all stations of the stone age.
Sciurus Europæus	Rob., Moos., Wang., Wauw.
Mus sylvaticus	Rob.
Lepus timidus	Rob., Moos.
Sus scrofa ferus	Rob. *et passim.*
„ domesticus	Wauwyl and the Western Lakes.
„ palustris ferus ?	Rob., Mei., Moos., Wang., Wauw., Con.
„ „ domesticus	Rob., Mei., Moos., Wang., Wauw., Con., Bienne.
Equus caballus	Rob. *et passim.*
„ asinus	Wauw.
Cervus alces	Rob., Mei., Moos., Wauw., Möringen, Con., Bienne.
„ elaphus	Rob. *et passim.*
„ capreolus[1]	Rob. *et passim.*
Capra ibex	Meil.
„ hircus	Rob., Moos., Wauw., Con., Bienne.
Ovis aries	Rob., Moos., Wauw., Mei., Con., Bienne.
Antilope rupicapra	Rob.
Bos primigenius	Rob., Moos., Wauw., Con.
„ bison	Rob., Wauw.
„ taurus primigenius	Rob., Moos., Mei., Con., Bienne.
„ „ brachyceros	Rob. *et passim.*
„ „ trochoceros	Con.
„ „ frontosus	Bienne.
„ „ domesticus	*Passim.*

Aquila fulva	Rob.
„ haliætus	Moos.
Falco milvus	Rob.
„ palumbarius	Moos., Wauw.
„ buteo	Rob.
„ nisus	Moos.
Strix aluco	Con.
Sturnus vulgaris	Rob.
Corvus corax	Rob.
„ corone	Rob.
Cinclus aquaticus	Rob.

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[1] Cervus dama was at one time thought to have left its remains in the lake dwellings; but Professor Rütimeyer has determined otherwise.

Columba palumbus	Rob., Moos.
Tetrao bonasia	Rob.
Ciconia alba	Rob., Moos.
Ardea cinerea	Rob.
Grus cinerea	Rob.
Fulica atra	Rob.
Larus, sp.	Rob.
Cygnus olor	Rob.
Anser segetum	Rob.
Mergus merganser	Rob.
Anas boschas	Rob., Moos., Wang.
„ querquedula	Rob., Moos.
Podiceps minor	Rob.

Cistudo Europæa	Moos.
Rana esculenta	Rob., Moos., Wauw.
„ temporaria	Rob.
Bufo vulgaris	Rob.

Salmo salar	Moos.
Esox lucius	Rob., Moos., Wauw., Nidau St., Con.
Perca fluviatilis	Rob.
Cyprinus carpio	Rob., Moos.
„ leuciscus	Rob., Moos.
„ dobula	Rob.
Chondrostoma nasus	Rob.
Lota vulgaris	Rob.
Scardinius erythrophthalmus	Rob.

SKULLS OF THE ASS AND OF THE OX FROM THE LAKE DWELLINGS OF AUVERNIER.[1]

By Professor Rütimeyer, of Basle.

Amongst the numerous specimens which have up to the present moment come under my notice from the lake dwellings, the two skulls from the settlements of Auvernier and Sutz, one of a kind of *Equus* and the other of a *Bos* are amongst the most perfect. On this account it was very desirable that they should be carefully examined, and the more so with respect to the skull of the horse, as the first glance was sufficient to show that we had not to do with the actual horse such as is generally found, although sparingly, in the lake dwellings: but rather with an animal related to the ass, properly so called, or one of its hybrid forms. In the latter case it stands to reason that great historic interest would arise from the fact. Besides this we had at least to keep in view the possibility that it might be some form different from that of the domesticated horse.

Unfortunately, notwithstanding the excellent state of preservation in other respects, just the very parts which chiefly distinguish the horse from the ass are wanting. The nose bones and the intermaxillary bone, the form and extent of which are especially characteristic in the ass, are both gone. With respect to the latter, its length may certainly be calculated from the under jaw, which is almost perfect, while the agreement of the remoter parts of this skeleton with the under jaw found some time since (so long a time having elapsed between the discovery of the two halves), is a proof that most certainly the whole animal had been bogged in the mud, and that consequently—as in fact all the other bones show—one cannot imagine that the animal had been used for food. The lachrymal bone also, which is so characteristic both in the horse and the ass, afforded no assistance, as its sutures had entirely disappeared, for the animal, as may be seen from its teeth, was not in old age, but was merely full grown. The dentition which was perfect to the upper incisors, indicates a female animal.

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[1] As my knowledge of comparative anatomy is very slight, and this paper is really a very difficult one to translate, I ventured to ask one of the leading comparative anatomists of England, Professor Rolleston, of Oxford, to look over my translation and to correct any errors I had made. To this he most kindly assented, and I have to return my best thanks for such valuable assistance.—[Tr.]

Without laying much stress on measurements in the case of animals which vary so greatly in size as horses, and thus afford but small data, and even these very difficult to determine as regards the skull, the following may be noted as a help to further comparison:—

	Inches
Length of the skull on the upper surface (a straight line from the occipital ridge to the border of the incisor part of the maxillary bone) . .	19·363
Length of the skull at the base (a straight line from the further edge of the foramen magnum to the border of the incisor part of the maxillary bone)	17·125
Entire length of the underjaw in the line of the alveolar border . .	14·369
Length of the toothless part of the upper jaw between the molars and the incisors (like all measurements which refer to the intermaxillaries, only of value by comparison with perfect skulls)	3·739
The same measurement on the lower jaw (there are only small traces of the canine teeth in the shape of small alveoli nearly closed up) . .	3·227
Length of the row of teeth in the upper jaw	5·983
Molar portion of ditto	2·638
Premolar portion of ditto	3·344
Length of the row of teeth in the lower jaw	6·259
Molar portion of ditto	2·991
Premolar portion of ditto	3·267
Greatest breadth of the skull at the zygomatic arch . . .	7·086
Breadth of the skull at the further end of the masseter crista . .	5·786
Breadth of the incisive portion of the lower jaw	2·322

These dimensions, as far as size is concerned, place the skull from Auvernier in the class of the ass, the zebra, the quagga, the kiang, &c. A regular comparison with the striped wild horse in all its parts might seem superfluous, and yet it may not be out of place to state that there are certain characteristic marks, less in the teeth than in the skull, which prevent these horses from being at all classed with the skull from the lake dwelling.

On the other hand it would be decidedly of importance to keep in view the so-called Asiatic wild horse, and also the ass and its hybrid forms.[1] I had, indeed, no materials for comparison and reference, except the skeleton of a kiang in our collection, unfortunately, according to all appearance, belonging to a menagerie animal, and the drawings of its dentition, published by Professor Owen in the Philosophical Transactions for 1864. Both tend to reject the idea that the Auvernier skull could have belonged to a wild horse of the nature of the kiang. There remains then only to be considered the tame ass with its varying forms, and even of these we may leave out what is called the 'hinny' (Maulesel), the reputed offspring of the horse stallion and the female ass. And considering that an undoubtedly genuine skull of this reputed hybrid form has probably never been submitted to comparison, everything that at various times has been said about this animal resolves itself into indefinite statements, which, in a treatise like the present, are not of the slightest value.[1]

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[1] Without here entering on the question as to the existence of the typical form of the horse in a wild state, it may suffice to remark that the more it is looked into the clearer it seems that genuine wild horses do not live either in Europe or in the whole of Asia. What are called the wild horses of Asia are probably limited to the forms which vary exceedingly, and stand nearer to the ass than the tame horse. The name of *Hemionus* has been commonly given to the Mongolian form, the term *Kiang* to that of Thibet, and the name *Onager* to that of the Caspian steppes. This is the opinion, as I had lately the pleasure of ascertaining, of Herr von Bogdanow, of St. Petersburg, who thoroughly understands the European-Asiatic fauna.

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[1] In spite of the superabundant literature on this head (from the Roman authors down to Buffon, Geoffrey St. Hilaire, Flourens, &c.), there appears to be an entire want of any positive data for the comparison of the 'hinny' with other forms of the horse, so much so that doubts may even have arisen as to the actual or even occasional occurrence of this spurious form. But Professor Pagenstecher has informed us that 'hinnies' are bred in some parts of Sicily. The following is extracted from a letter which I have received from Mr. H. von Nathusius, of Hundisburg, who is a thorough 'expert,' and without doubt stands in the foremost rank of those who are able to judge of the matter (for he possesses the most perfect and instructive materials for the study of the horse, as his collection contains approximately 200 skulls of the horse and ass, and also a dozen skeletons). I have often applied to him for advice; his words are as follows: 'I spoke in the first instance of the "hinny," in a paper read to the Physiological Society of Gottingen, at the suggestion of R. Wagner, and again in my treatise, "Vorträge über Viehzucht," p. 119, it is evident that I did not deny the existence of the "hinny," but simply affirmed that it was not sufficiently known scientifically to lay down any laws of its descent from the differences between it and the "mule." Even to this day nothing definite has come to my knowledge respecting this hybrid form, excepting some statements as to its larynx, by no means satisfactory, obtained from veterinaries, and also from the paper by E. Rousseau entitled "Des châtaignes et plaques épidermiques" (Revue et Magazin de Zoologie, Novembre, 1852). I have never been fortunate enough to see a living "hinny," or to obtain preparations from one. At the present moment one of these animals is in the Agricultural Institute at Halle, and will in due time be examined. With respect to the regular mule I have observed great variability of form in every variety of it.'

Two reputed skulls of the 'hinny' were lately shown to me in the veterinary school at Lyon, by M. Toussaint, and in the institution of Toulouse my attention was drawn to the skeleton of a 'hinny' by M. Arloing; and yet in all three cases there was a want of the precise information required to enable us to determine the exact localities where these specimens were obtained, and I felt a strong desire to undertake a detailed and accurate investigation of these skulls. It was, however, striking that all of them exhibited more or less a pug (or flat-nosed) form, the incisive portion of the upper jaw being shortened, while the under jaw was turned up over the edge of the incisors on the upper jaw. At Toulouse the same malformation was observed in a skull which was considered, and quite correctly, by M. Arloing to have belonged to an ass. Besides this the reputed skull of the 'hinny' was completely and entirely

If we regret, as we must do, the want of materials for comparison in the case of the hybrid form just mentioned, we shall have the same feeling in a still greater degree with respect to the two well-known forms of the ass proper and the mule. As to the one first-named, I have indeed before me for examination certain skulls of different ages from our own collection, but unfortunately only a single skull of the mule from the collection of the University of Freiburg. According to the catalogue it 'belonged to a mule about nine years old, well bred, and of unusual size.' This latter assertion is decidedly borne out by the size of the skull, which nearly equals that of a handsome horse. With respect to the first the skull can hardly make any pretensions to participate in the good breeding of the species, at least so far as the teeth are concerned, most certainly no unimportant indications in the case of a domesticated vegetable-feeder. I have seldom seen a horse's skull with more abnormal teeth.[1] There was not a single tooth which could be called normal, and what is more, and proves the skull to be unique of its kind, it had, if I remember rightly, a row of seven great or columnar molars in each of the four half-jaws. In any normal set of teeth this extraordinary arrangement would have been of great palæontological interest. In this case it was clear at the first glance, not only that the first premolar, P 4, which in modern horses is deciduous or at least diminutive, had been uncommonly developed, but that a very irregular and large extreme extra tooth had, in a very unhealthy manner, been added posteriorly to each of the four rows of molars. Even if the tolerably regular form of all four P 3 had not shown this, the fusion which had affected some opposed molars for nearly their entire extent, owing to the unexpected intrusion of the extra tooth, would put the matter beyond a doubt.

With only a single specimen available, it would be hazard-

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diseased, and affected with a number of abnormal synostoses, the splint bones anchylosed with the metacarpus, &c. The skull of this skeleton in the hinder part, in the forehead, &c., had the characteristic marks of the horse, but on the other hand the incisive portion of the jaw was strikingly short, as it is in the ass. The hoofs were about twice as large as those of the skeleton of a regular mule about the same size.

[1] The skull of the kiang, most undoubtedly an animal from a menagerie, comes very near to it. In this skull one of the rows of teeth in the upper jaw is altogether very irregularly worn down, and the two anterior permanent premolars are replaced by a single very irregular tooth, and consequently there are only five teeth in this row. And yet it may be easily seen that this has arisen from early caries of the palate, and that the second tooth only became larger in consequence of the absence of the neighbouring tooth.

ous to lay down the distinctive marks of the mule's skull. Nor is this the place to enter very minutely into the marks which distinguish the skull of the horse from that of the ass. But it may be of great interest to mention those characters which appear to offer a standing-point for studying both species. From the specimens lying before me, the skull of the ass differs from that of the horse in the following particulars:—

1stly. In its smaller size.

2ndly. In the shorter length of the toothless intermaxillary part, both in the upper and lower jaws. The distance measured on the median line of the skull, from the edge of the incisors to a line drawn across in front of P 3, has the following proportions, compared with the whole length of the skull (from the edge of the incisors to the furthermost border of the foramen magnum) in skulls which have complete sets of teeth:—

In the Horse ...	26	—	28	:	100
„ Zebra ...	27	—	30	:	100
„ Kiang about	25			:	100
„ Ass ...	22	—	23	:	100

In the under jaw there is the same proportion, although it is more difficult to measure. (The intermaxillary portion, as before, and the length of the jaw-bone are measured in the line of the alveolar edge):—

In the Horse ...	27	—	29	:	100
„ Zebra ...	28	—	32	:	100
„ Kiang ...	28			:	100
„ Ass ...	24	—	25	:	100

3rdly. The occipital surface, with its condyloid process, is more perpendicular and more at right angles with the upper surface of the skull.

4thly. A flatter and broader forehead, and in general a greater diameter of the skull, in the parts of the orbits and the cheeks, compared with the length of the skull. If the length of the skull compared with the above measurements be considered 100, then the greatest breadth to the zygomatic bones would be as follows:—

In the Horse ...	40	—	41
„ Zebra ...	43	—	45
„ Kiang ...	45		
„ Ass ...	44½	—	46½

5thly. The form of the nasal bones gives strong expression to the foregoing proportions, as they are much stronger and broader in the ass than in the horse.

6thly. The lachrymal bone of the ass, partly in consequence of the above proportions, differs from that of the horse in having a smaller facial surface, and of a different form.

7thly. The orbit in the ass is proportionally smaller than in the horse, and its hinder edge or border (what is called the arch of the eye) is broader and more projecting than in the horse.

8thly. Lastly, there are certain characters in the teeth of the ass, the discussion of which here would lead us too far from our subject.[1] All the rows of molars, both in the upper and lower jaws, appear pressed together when compared with those of the horse. This is most evident in the striking shortness of the furthermost, and in the much smaller measurement of the hindermost teeth of the row of molars. The best and latest drawing is that of Professor Owen (Phil. Trans. 1864, pl. lviii).

Now if we apply these distinctive characters, taken from the domesticated animal of the present day, to the skull of the horse from the lake dwellings of Auvernier, we shall obtain the following result.

The skull is in dimension between that of the horse and the ass, and is in size nearer to that of the kiang and the zebra. The extent of the toothless part, both of the upper and lower jaws (so far as we can calculate from the first), is more considerable than in the skulls of asses which are now lying before me, and resembles more that of the kiang and the horse. The occipital surface is in the same proportion as in the ass. The measurement across the skull, and the peculiar form of the nasal bone, which arises from it, are like those of the horse. On account of the complete obliteration of the sutures, nothing can be said as to the lachrymal bone. The orbits are formed like those of the horse. The teeth, which are in good preservation, and are remarkably regular in form and in wearing down, ought in consequence to have afforded the best information. And yet the determination is very difficult. A great number of measurements, which were made both to compare the space occupied by the teeth with the length of the skull (that is, the skull and the lower jaw as taken in the above tables), and also to obtain a distinctive mark between the horse and the ass from the proportions of the row of premolars to that of molars, were found to be either useless or unsatisfactory from the paucity of materials as regards the ass. Thus the proportion between the length of the row of teeth in the upper jaw and the length of the skull (the latter being taken as 100) was for the horse 32—35·6, for the ass 35—38·5, and for the skull from Auvernier 34. The length of the row of premolars, compared with the full row of teeth of the upper jaw (the latter being considered 100), was for the horse 53·5—58, for the ass 53—53·5, and for the lake-dwelling skull 56. The length of the row of teeth in the lower jaw compared with the full length of the lower jaw (considered as 100) was for the horse 37—41, for the ass 41—44, and for the Auvernier skull 42. The row of premolars of the lower jaw, compared with the whole row of teeth (considered as 100), was for the horse 51—53, for the ass 49, and for the Auvernier lake-dwelling skull 52.

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[1] On this point I would refer to the drawing appended to my essay, critically examining the horse of the quaternary period. (*Abhandlungen der schweizerischen palæontologischen Gesellschaft*, 1875.)

In spite of all the uncertainties which not only seem to be attached, but from their very nature are so actually attached to these measurements, there can be no doubt in my mind that the lake-dwelling skull belonged to an ass. Although I have horses' skulls now lying before me in which the dimensions of the several groups of teeth, nay, even of single and the most typical teeth, such as the furthest and last, agree to a millimetre with the measurements of the lake-dwelling skull; still, the character of the ass's tooth very decidedly adheres to them as I have fully explained in the above-mentioned treatise. I have there brought them into comparison with the teeth of the regular horse, as even in the earlier stages of life they bear the type which the teeth of the horse do not exhibit till they are considerably worn down, and in the columnar teeth are very near the roots. In short, it arises from the very decided compression of the body of the teeth both before and behind, by which not only three premolars and three molars, but all the teeth are developed more in a cross than in a longitudinal direction, and the numerous folds of enamel are forced into a more diagonal direction than occurs in the horse at a similar age. The drawing of Professor Owen already mentioned, gives a capital representation which agrees even in size with the teeth of the lake-dwelling skull, and which seems to have been taken from just such a splendid animal, and probably as far as the characters of the skull are concerned from such an equine beast, that, from what we have written above, it might have been the one found at Auvernier.

The same plate of Professor Owen gives a more normal set of teeth of the kiang than I have access to, and proves that the kiang, to which the lake-dwelling skull appears to have much resemblance, must be put out of consideration.

This full discussion of the lake-dwelling horse may perhaps be justified by the fact that both from the bones found, and also from drawings by contemporaries' hands, it is most probable that large herds of horses which cannot be proved to have been tame, inhabited the country, at least the neighbourhood of the Jura from Schaffhausen to Geneva, apparently before men had taken refuge in erections on the water, and when they only used such natural retreats as were to be found on the mountains, and the above district is the very one from which came the skull under consideration. And moreover, if the structure of the teeth, notwithstanding many points in the skull which seem rather to point to the horse than the ass, gives a turn to the scale—if we consider that the value of the characters derived from the teeth is greater than that of those from the skull, especially in an animal so fully provided with them as the horse, we may probably be justified in concluding that the skeletons of the ass in our collections represent rather the crippled form to which this animal has been brought by utter neglect, than its original natural peculiarities. We shall be led to the same conclusion if we examine the few remaining portions of the skeleton. They consist in fact of a few fragments of bones, but fortunately of those which more than any others enable us to form an idea of the whole animal: they are the humerus and the two last phalanges both of the hind and front foot. The evidence given by them is of very great importance, as there can be no doubt that they belonged to the same individual animal as the skull.

The humerus is 9·369 inches long, measured from the upper condyle to the condyle of the radius, and is 2·362 inches wide at the condyle. Amongst the skeletons in our collection this agrees best in size with the kiang, in which the above measurements are 9·448 inches and 2·676 inches. In the skeleton of an Arabian mare the dimensions were 12·204 inches and 3·149 inches.

The greatest diameter of the coffin bone of the hinder foot is 2·44 inches; the great pastern belonging to it is 1·81 inch where it is broadest, and 1·181 inch in length from the condyle to the pulley joint. In the forefoot the measurements are 2·676 inches, for the coffin bone, 1·81 inch and 1·181 inch for the great pastern, which differs from that of the hinder foot merely by being broader in the middle.

In the kiang the same measurements are 2·086 inches for the hinder foot, 2·164 inches in the fore foot; in the skeleton of the Arabian mare, mentioned above, 2·873 inches and 2·951 inches; in the skeleton of a common horse 3·739 inches and 3·937, and in the remains of the wild horse from the cave at Thäyngen 3·03 inches and 3·267 inches.

From this, it results that the animal in question was nearly of the stature of the kiang, and was about 49¼ inches high at the withers, but the breadth of its hoof was somewhat greater than that of this animal.

If lastly, with these results before us, which may probably throw some light on the history of the ass, we review what has been discovered up to the present time, the oldest traces of this animal known to me certainly reach far back into past ages. At least, I consider this to have been the case with a number of bones from the caves of the island of Pianosa, near Elba, of which I have given reports on several occasions since the year 1864. The ass was there found in company with animals which we have to attribute to the Pleiocene era—stags, antelopes, buffaloes, and a species of horse which differs from that of the present day, and the teeth of which are intermediate between the modern horse and the genuine pliocene form of *Equus stenonis*—Cocchi. Together with this horse, the remains of which indicate an animal of the average size of our modern horse, there were found remains—teeth and pieces of the bones of extremities, which belong to an animal not bigger than an ass. It may suffice to state that the hoof phalanges of the hinder foot were only 1·574 inch in breadth, while the analogous bones of the *Equus fossilis* from the same cave were 3·149 inches in diameter. Not taking into account the variety which the great and small teeth exhibit in their structure, it seemed very improbable that amongst the remains of what doubtless was a wild horse there should be such an amount of difference merely arising from the larger or smaller size of individuals.

It is of far more importance to bear in mind that amongst the large number of equine remains found in the inhabited caves of the stone age hardly a trace of the ass is to be found. Neither the caves of Salève nor of Thäyngen in Switzerland, where the remains of the horse either domesticated or as an animal of the chase occur almost as plentifully as those of the reindeer—neither Solutré near Lyon, nor the caves of Perigord, where the remains of the horse are still more abundant—neither the Belgian nor the English caves have afforded any trustworthy data as to the existence of the ass amongst the cosmopolitan assemblage of animals found together in these caves. All that is known of the ass at this period is in the highest degree isolated. All that I am aware of at the present moment are, some small equine remains in the cave of Oreston mentioned by Owen, and in a cave in the department of Lot by Gervais, also some in the cave of Langenbrunn near Donaueschingen, excavated by Professor Ecker, where a few bones about the size of those of the ass were found associated with those of the mammoth, the hyæna, &c.

The information to be obtained from the age of the lake dwellings is no richer. Neither is that from the Terramara nor the 'Nekropoles' of Italy. It is limited just as in the case of the fauna found in the caves to a few very insulated cases, as, Wauwyl on this side of the Alps, and a similar instance in the fauna of the Terramara.

The skeleton from Auvernier is consequently the first relic found in Switzerland, which enables us positively to speak at least as to the old historic times of the occurrence, together with the horse of a second species of the same genus distinguished by its being of considerably smaller size.

With respect to the skull of the ox found in the lake dwelling of Sutz its characters may be briefly described, as it agrees in every respect with the skull from Concise noticed in my fauna of the lake dwellings, page 137, and there considered as the representative of a *Trochoceros* race of oxen; only it is somewhat larger. The smallest breadth of the forehead between the borders of the temples is 7·676 inches, the breadth of the occipital border between the horns is 6·299 inches, the circumference of the horn at the base 9·251 inches, the horizontal diameter of the base of the horn, 3·188 inches; the vertical diameter, 2·716 inches. As at that time I considered the remains from Concise and Chevroux, which were nearly as perfect, to be those of domesticated animals, so now the skull from Sutz convinces me anew that in the west of Switzerland a race of very large cattle, not at all less than the largest of our oxen of the present day, was bred there at a time when we find very generally in Middle and East Switzerland a small breed, though perhaps originally coming from the same stock. I may assume that it is known that in my subsequent works on oxen, it has been shown that the *Trochoceros* form was not to be considered as a race but only as an individual variety (and that by no means a rare one) of the *Bos primigenius*, and this applies both to its wild and its domesticated condition (amongst domesticated animals this variety would perhaps be called a breed). I can refer on this point to a large number of publications.

Another question which it may be too early at present to discuss is in fact whether this uncommonly large breed of cattle with peculiar horns, which hitherto has only been met with sparingly in the bronze age stations of West Switzerland,[1] is to be considered as a native race or only one brought by accidental circumstances into Switzerland. The peculiar limits, both historically and topographically, within which these remains are found, lead me to incline to the latter opinion as the more probable. If such be the case, we may easily imagine the ass—its neighbour at Auvernier—to have come here by the same route.

And now, after having considered these few animal forms which appear almost as strangers amongst the far richer native fauna of the lake dwellings, we may close the list—and again, chiefly following the line of lakes in West Switzerland—by the discovery of a dog, which by its great size differs from the little dog found in several lake dwellings. At a rapid glance the question forces itself upon us, whether these foreign animals may not have been rather the chance leavings of a great barter or market brought within the range of an older fauna of wild and tame animals, than the traces of a transformation of native domestic races.

This view, to which I was led by my previous knowledge of the animal remains from the lake dwellings of West Switzerland, receives according to my opinion no slight confirmation from the results just afforded to me by examining the large number of bones from the lake dwelling of Schaffis on the lake of Bienne. To antiquaries this settlement is well known, and to zoologists it is interesting, as the fauna corresponds with that of Concise. Although most of the wild animals of the lake-dwelling period are found here in abundance, more especially the bear, which still exists at the present day concealed in the Jura, yet the domesticated animals considerably outnumber them. Those which everywhere indicate the older settlements, and in Middle and Eastern Swizerland exclusively so, are very numerous. But again, as almost everywhere on the line of lakes of West Switzerland, side by side with the well known domesticated animals which have been called by the names peat cow, peat swine, peat sheep, peat dog, &c., some rare individuals of a somewhat foreign breed have been found, as for instance, a great sheep with very powerful horns bent sideways, one individual goat of a large size with uncommonly strong horns, and even here some bones evidently of a very large ass, to all appearance a foreign animal left behind by chance from some ancient barter or market, and now appearing as strange to us amongst the remains of cattle settled here in the olden time, as the domestic races of African or Asiatic origin would seem amongst our own, although we look upon them only as other breeds of the same species.

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[1] My friend Dr. G. Lisch, of Schwerin (November 1863), informed me that a skull belonging to the same breed, and nearly perfect, had been found in the peat moor of the Penefluss, near the town of Malchin, in Mecklenburg. Dr. Lisch has announced it in the *Archiv für Mecklenburgische Geschichte und Alterthumskunde.*

CHEMICAL ANALYSIS OF THE BRONZE IMPLEMENTS.

BY PROFESSOR L. R. DE FELLENBERG, OF BERN.

THE analysis of the bronze implements found in Switzerland and the neighbouring countries, which was undertaken by M. de Fellenberg at the request of Professor von Morlot, is of great interest. The results of these investigations were published by M. de Fellenberg in the Transactions of the Natural History Society of Bern, in the years 1860 and 1861. It appears from this communication that the bronze of many of the weapons and implements discovered in the western part of Switzerland consists of pure tin mixed with copper in which there is a little nickel; while not a trace of this metal is to be found in bronze objects met with elsewhere. As mines of copper and nickel, which last are worked at the present day, are found close together in the Vale of Anniviers, in the Valais, M. de Fellenberg conjectures that the copper of the implements containing nickel has come from the Valais. In the second report he makes the following observations:—'The drop-shaped refuse from the crucibles, and the lines showing the joining of the two sides of the mould, found in many places on the implements, both of bronze and copper, lead us to conclude that they were actually manufactured and cast on the very spots where they were found —as, for instance, Tschugg, Estavayer, and Echallens, and that they were made out of tin obtained by commerce, and copper brought from the neighbouring district of the Valais.

'According to the small assay of ancient tin which I have been able to make, it may be considered as pure, for there was only a trace of iron, and no other metallic ingredient. It consequently follows that (especially in Cornwall, which probably in ancient times supplied the tin) that was preferred which was made from what is called "stream tin," by being repeatedly washed and then melted in a furnace.'

(FOR COMPARISON.)

SETTLEMENTS OF THE SAME PEOPLE ON THE MAINLAND.

I. SETTLEMENT AT EBERSBERG.

It must be a matter of the greatest interest, after we have been examining all the rich stores of antiquities obtained during the last few years from the lakes of Switzerland and the adjoining countries, to inquire whether any settlements have been observed on the mainland, the antiquities of which correspond with those of the lake dwellings, and thus throw some light on both classes of settlement.

The reply to this question is, that there are several localities of this nature; amongst which may be mentioned Ebersberg, near Berg, on the Irchel; Burg, near Vilters; Uetliberg, and Windisch.

The place named first is of especial interest, as it has been examined, excavated, and reported on by Mr. G. von Escher von Berg, first in 1851, and subsequently in 1862. Numbers of antiquities have been found there, and it appears in fact to be a settlement on the mainland agreeing with the lake dwelling of Nidau-Steinberg, both as to the civilisation of its inhabitants and the period of its existence: it agrees also in general with all those settlements which were founded in the stone age, and continued inhabited till the bronze age, but were abandoned before iron came into common use. The stone celts, flint knives, what are called corn-crushers, tools of horn and bone, as well as the implements and ornaments of bronze, all appear perfectly identical with the antiquities of the lake dwellings on both sides of the Alps. And in the presence of this fact, the correctness of the conclusion cannot be doubted in the slightest degree, that the settlements of the same people who erected the lake dwellings were also spread over the mainland.

Before giving the substance of the two reports on Ebersberg by Mr. G. von Escher von Berg, which shall here be combined in one, it may be well to make one or two remarks on the pottery which has been found at this place.

A consideration of the earthenware vessels here discovered, made of such various forms, and in some cases not without taste, and always answering the required purpose, both in form and material, leads to the impression that at Ebersberg, as well as in the lake dwellings, the manufacture of earthenware vessels formed a particular occupation, and that it was exclusively carried on by individual settlers. The mixture and working of the clay for the particular sorts of manufacture, the form of the vessels made by the hand alone, their ornamentation, and the mode in which they were burnt, show, in the opinion of those conversant with the art, such a degree of ability and proficiency, that only those individuals who devoted themselves exclusively to this work could produce such wares as we now see before us.

As the vessels made of clay took the first place in the household economy of the settlers for keeping both their liquid and solid food, and also were their only cooking utensils, it may be easily imagined that the faculty of invention very early introduced a great variety in the form and ornamentation of these products.

The following is the substance of Mr. G. von Escher's two reports condensed into one:—

The mountain ridge of the Irchel terminates at its northwestern extremity in the bed of the Rhine, or rather, it may be said to project into this river. For it seems as if at some fargone time the Rhine had found a way through the mountains which previously dammed up its waters so that they spread over the adjoining flat country. It now flows through a narrow channel between the terrace cliffs of Schaffhausen, four or five hundred feet high, in a southerly direction, till the Töss runs into it, when its course takes a sudden turn nearly at right angles. On either side of what was formerly a lake, rise two hills commanding the flat land far around—the 'Haarbuck' (perhaps originally Hardbuck) on the right, and the 'Ebersberg' on the left bank of the river. The latter hill stands alone like an outwork of the high Irchel, from which it is separated by a valley. It is not unlike a four-sided pyramid the top of which has been taken off by the hands of man, and has a flat surface on the summit, of about an acre and a half. On the west side it slopes precipitously to the river, which runs below at a depth of 550 feet; and on the southern side is the only gentle slope, which is prolonged to a hollow or gorge running to the Rhine at right angles, so that here also the hill is isolated. In addition to this, there is here a trench running in an oblique direction, the lower part of which has disappeared under cultivation, and it terminates above before it quite reaches the plateau of the hill. There is no doubt that this trench was made by the settlers to secure the only accessible part of the hill. As the place offered great advantages for safety, it must, necessarily, in all ages, have attracted the attention of the inhabitants of the country. As a point of observation also, Ebersberg was of considerable importance, for nothing could escape the view of a watchman set upon the top, either on or near the river, from the falls of the Rhine down to the mouth of the Töss. In this respect there is no height like Ebersberg for a view over such a wide extent of country. It is well known that a stronghold was situated on the point of Ebersberg till the year 1336, when it was destroyed by the people of Zürich in a feud with the nobles of the district. Before that race of barons, it may reasonably be assumed that the Romans, who founded several stations along the Irchel, had used Ebersberg for military purposes, and had at least placed a specula on this spot. But till these excavations it was never supposed that the first inhabitants of the country ever had a settlement here.

The original discovery was made in the following manner. In May 1851, I was accompanying a friend on the road leading near one or two ancient sites, through the pass between the Rhine and the Irchel, to the spot where the castle of Radeck formerly stood on a spur of the mountain. I had already reached the southern slope of Ebersberg, immediately above the gorge mentioned above, when I saw some labourers at work with carts. As there is a gravel-pit on this side of Ebersberg, I thought that the people were busy repairing the road, and fetching material for this purpose. But when, on my return, I met one of the carts, I was not a little surprised to remark that it contained rich black mould, mixed with a large quantity of charcoal and bits of burnt clay, and that they were using it for agricultural purposes. They told me that in the place where the carts were loaded broken pottery was found in abundance, and besides this, bronze pins, teeth of animals, and horns of red sandstone with engraved lines, had been discovered there. Of course I made haste to the place, and secured the above mentioned specimens. Fragments of brownish unglazed pottery (evidently of Gallic make) had turned up in great quantities, and I also found the problematical stone horns with the characteristic zigzag Gallic ornaments. By the kindness of my neighbours, I succeeded in obtaining, the same day, several other implements of bone, stone, and bronze.

In consequence of this, an excavation was commenced by me, jointly with my friend Mr. Edward Merian, of Teuffen, and carried on for a week with four men. Unfortunately, a cross-road, very much used, ran immediately over the place which promised the best results; in addition to which it was a serious and costly work to remove a bed of alluvial earth five feet thick, which we had to do before reaching the layer containing the antiquities, now called the relic-bed. This great depth of alluvial earth over the area once occupied by the settlement, which is marked by the burnt wood, the clay burnt red, the black earth very much trodden down, and by all the objects of human industry found here, was at first a mystery to us, and we were tempted to imagine some slip of the ground; but, on later examination, this is impossible: the covering of earth was not made in this way, for there is a total absence of gravel in it, but it is simply the power of nature alone which has here been at work: this bed has evidently been formed by a very slow alluvium coming from the land above. Who can say what changes in the conformation of the surface of the earth may have been brought about by a power constantly acting for three thousand years?[1]

A layer of charcoal ashes was met with almost everywhere over the remains of the old settlement, and besides this, in the first excavation above referred to, many of the antiquities found seem to have been damaged by fire. It seems, therefore, reasonable to conclude, that at least a part of this settlement was burnt to the ground, but whether this catastrophe was caused by chance or by the hand of an enemy I do not venture to decide. In the notice of the later excavation some reasons will be given which show that the latter view of the case is improbable.

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[1] There is something to my mind very inexplicable in the depth of soil under which ancient remains are occasionally buried, especially in those localities where earth is not likely to have been washed down from higher grounds. In a field which forms the south-west portion of the ancient city of *Isca Silurum*, I have frequently excavated for the sake of archæology, and in one instance, when the summer was dry, the grass showed where walls were probably to be found, indicating the ancient Roman houses, forming the corner of the inhabited portion, an open space or street being between them and the city walls. It was, however, very singular that these indications, though correct, were not verified till the ground had been excavated to a depth of five or six feet; and before the actual base of the wall and the floor of the street were reached, a tall labourer was entirely hidden from view. The first foot or two may be accounted for by rubbish, when the place was destroyed, but as no soil is likely here to have been brought down by floods, we are almost obliged to attribute the remaining four or five feet to the annual additions of vegetable mould. The excavation above referred to, is not the only fact which indicates a great accumulation of soil; a handsome tessellated pavement, lately discovered in the churchyard, was four or five feet below the present surface, and one can hardly imagine that it was so originally. The trees also, in many of the gardens at Caerleon, flourish very well till their roots go down to the Roman rubbish, when they immediately begin to wither. May not the mass of earth, spoken of by Mr. G. von Escher, have arisen from a gradual accumulation of vegetable soil?—[Tr.]

The second excavation in 1862 was much more extensive than that in 1851. The work began on June 13, and, with some interruptions, it was continued till August 9. In sixty-four days an area was excavated of from 4,500 to 5,000 square feet.

The 'relic-bed' was a foot and a half thick, and, as before mentioned, about five or six feet deep, and, with its numerous fragments of pottery, its stone and bronze implements, and its animal remains, rested in general upon a floor consisting of clay and pebbles carefully beaten to a level. In two places there was a pavement of pebble stones. Two hearths were found on this floor, near to one another, in the shape of parallelograms, about five or six feet long and three feet broad, made of rough pebble stones and clay mixed with a very large proportion of sand. The loose 'relic-bed,' as already mentioned, consists, in great part, of a mixture of rich black earth, small pieces of charcoal and bits of clay burnt red, and is very distinct in colour from the overlying bed of earth, five or six feet thick, in which no remains have ever been found. Close to the original floor there was, throughout, a bed of ashes varying in thickness. On and in this bed we found a very large quantity of animal remains.

We will now proceed to describe the antiquities found at Ebersberg, including those discovered in both excavations:—

1. *Pottery.*—As far as numbers are concerned, the fragments of different descriptions of earthenware vessels take the first place. Very many were found when Ebersberg was first examined, and in the later excavation more than 1,500 pieces were found, of which, however, only about 250 are worth preserving. Very few vessels were met with entire, but still, from the fragments, the shape of many can be very distinctly made out. They agree in form, to a considerable extent, with the earthenware vessels found in the tumuli, as may be seen by comparing them with those drawn in the third volume of the Transactions of the Zürich Association, and which illustrate the paper entitled 'General Remarks on the Pagan Graves in Switzerland;' there are, however, several forms, not given in these illustrations, which are found at Ebers-

berg, as well as several new kinds of ornamentation. I have therefore given, on Plate CXLIII. fig. 10, the 'restored' forms taken from the fragments of several vessels not drawn in the above-named treatise; and in Plate CXLIV. figs. 1 to 15, will be found several of the kinds of ornament not given there. These forms and ornaments are frequently met with amongst the fragments.

The variety of the patterns on the ornamented pottery is really perfectly astonishing, if we consider that it is brought about almost exclusively by combinations of straight lines, and that curved lines are very seldom used. Most of the vessels are ornamented on the outside. Inside ornamentation is only found on flat or open vessels like plates or dishes.

Many of them have been coloured either with ruddle or with graphite, which appears to have been well rubbed in and smoothed. None were found painted with two colours, like some of the Gallic pottery. In certain cases the line ornaments, which were often not conspicuous to the eye, were set off by the furrows or lines being filled with white chalk.

The material out of which the pottery was made varies considerably: sometimes the clay was unwashed and full of extraneous substances; sometimes it was intentionally mixed with grains of quartz and felspar; and sometimes the vessels were made of carefully washed clay and were of really good workmanship. Of many hundred vessels, the fragments of which lie before me, I am assured by those who are skilful in the potter's art, that none of them indicate the use of the potter's wheel; all were made by the hand alone, finished with the scraper, and burned, not in closed furnaces, but in open fires, consequently they are badly and not uniformly burned—at all events they do not ring when struck.

The fragments of the earthenware vessels show all possible variety, both in size and form, from shallow to closed vessels, and from little cups to capacious urns, in which corn and other materials might be stored. Many of them had neatly-formed handles, so that they might either be carried or suspended. Several forms have been already referred to. Plate CXLIII. fig. 10, is 'restored' from fragments which clearly indicate the shape; but there are others which have fortunately been preserved entire, such as those drawn Plate CXLIII. figs. 8 and 9, and Plate CXLV. fig. 4, respecting which the drawings will speak for themselves. The large vessel drawn Plate CXLV. fig. 1, is remarkable both for its form and ornamentation; but this is not all, it is one of several specimens which have been found at Ebersberg, where there is the same problematical arrangement which has been already referred to elsewhere in this volume, namely, a row of holes either vertically or diagonally one above the other, chiefly near the border or edge. The vessels with this peculiarity vary very much in form; sometimes they are shaped like a plate, sometimes like a bowl or cup, sometimes they are hemispherical below and cylindrical above, in which case the row of perforations is vertical. The holes are always made in the line ornaments which run round parallel with each other; they are not always of the same size; in the smaller vessels they are narrow, and in the larger ones they are broader. It is difficult to imagine what could be the use of these holes; if they had been intended to have drawn off a portion of the liquid contained in them the lowest hole would have been sufficient; and the same remark will apply to the idea that they were intended to drain the water from moist food which was required to be dry. Vessels with similar holes have been found in the ruins of the lake dwellings, and the use of them has been generally explained by supposing that they were intended to separate the whey from the curdled milk. I venture, however, to propose another explanation: may not these vessels have been used to separate the honey from the honeycomb? It is evident that at certain temperatures the honey would flow through these small openings, leaving the wax behind. This hypothesis deserves the more consideration as a similar plan is said to prevail at the present day both in the Emmenthal and also in the Bernese Jura. These perforated vessels were not met with very commonly in the first excavation; amongst the fragments of perhaps 500 vessels only five borders were found with this peculiarity. In the late excavation they were found in much greater abundance.

Amongst the more perfect earthen vessels found here, one is especially worthy of notice; it is a small pipkin made by the hand alone, but very neatly fashioned out of purified clay, and it is remarkable for having no base, but terminating below in a cone. The clay rings, well known in the lake dwellings of the western lakes, were also found here, and the two sets of specimens throw light on each other. The pipkin was evidently set upon the clay ring, and both together were then placed on a hearth of glowing embers and charcoal. This arrangement, in fact, was by no means a bad one, because by this kind of stand the sides of the pipkin were gradually and not suddenly heated, and thus the fluid contents were not burnt at the bottom. A sketch of both the pipkin and the ring is given Plate CXLV. fig. 3.

To this class of objects probably belong the little cylinders wider at the top and the bottom, the actual use of which is unknown, but which occur of exactly the same form in the lake of Bienne, and are drawn Plate XXXVII. figs. 6 and 7.

The implements in the form of a pyramid, perforated at the top, Plate CXLV. fig. 11, were used doubtless for stretching the threads in the loom.

The objects drawn Plate CXLIII. figs. 2 and 3, and CXLV. figs. 12, 20, and 21, are evidently spindle-whorls.

Under this head may also be noted a number of fragments of the layer of clay which covered the wattlework walls of the huts. These pieces were tolerably smooth on one side, but on the other showed the deep impressions of the basketwork. Plate CXLIV. fig. 16. On one side also they were hardened and coloured by the action of fire, but on the other side they were soft—a proof that they had not been burnt till the conflagration of the huts.[1] Fragments of clay flooring were also found, some inches thick, beaten down above like a threshing-floor, but uneven below, and filled with small pebbles, stones, and other kinds of things which happened to be on the ground when the flooring was laid down.

2. *Crescents.*—Though one of the objects which bear this name is of pottery and the others of stone, yet, as they are of especial interest, they deserve a section to themselves. Amongst all the objects brought to light in the first excavation at Ebersberg, probably that drawn Plate CXLV. fig. 17, is the most remarkable. One horn is wanting in the original specimen, which consists of the base and one horn only, but the second has been added in the figure, as, from specimens subsequently found, there can be no doubt as to the form of these objects. The first view of the original specimen gave the idea of a horn, but on examination it was clearly seen to be only part of a figure representing the crescent moon. The specimen was the first which had come under the notice of antiquaries, and, till its discovery, images of this form appeared to be totally un-

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[1] In the narrative of the expedition to the Zambesi, it is stated by Dr. Livingstone, p. 534, that the huts have no ruins except when they are burned, and then a thin layer of the red clay with which they were plastered, and the impressions of the reeds which formed the walls, remain, with the colour and consistence of soft bricks; but these soon moulder away.—[Tr.]

known, both in Switzerland and other countries. As these peculiar images have been very fully treated of in the chapter specially devoted to them, it will be only necessary here to describe the specimens found at Ebersberg, and to say that they are frequently considered as objects of Gallic worship.[1]

The specimen, Plate CXLV. fig. 17, is of reddish sandstone, and is ornamented on one side with line ornaments.

The smaller half-crescent, Plate CXLIII. fig. 7, also of reddish sandstone, is covered on the front with line ornaments; it only differs from the last in size and mode of ornamentation.

Fragments have also been found made of the same material, and exceeding the first in size; as they had no ornaments upon them, they probably belonged to the back of the image.

These crescents, however, were not all made of stone. Plate CXLV. fig. 5 is in terra-cotta, and was found in the later excavation. It is 6 inches high, and 10½ inches in width.

In some respects it resembles the stone images described above, and in others it bears the greatest similarity to those found in the lakes of Bienne and Neuchâtel, which are also made of clay.

3. *Stone Implements.*—Three small stone celts were found here: two of them are of a kind of stone like serpentine, the other of brownish flint, Plate CXLIII. figs. 5 and 6. The celt drawn Plate CXLV. fig. 24, is of a stone like nephrite. Some cutting implements were met with made of flint, from the chalk formation of the Jura; this flint is found amongst the rolled stones of the gravel covering the banks of the Rhine, especially in the basin below the falls of Schaffhausen. Some roundish stones of granite, flattened at both ends, and commonly called corn-crushers, Plate CXLV. fig. 22, and also a number of stones of various sizes, made apparently by human hands into the shape of balls or eggs, occurred here.

A large piece of reddish sandstone, with several continuous lines and elevations, is not without interest. At first sight it looked very like a moulding or cornice, though this idea did not at all agree with the grade of civilisation shown in other objects found here. But on examination the furrows and rounded grooves are not of the same depth nor breadth, neither do they run parallel with each other, so that in this supposed moulding I recognised a whetstone or grindstone for the manufacture of celts and other objects such as we have described. Similar slabs have since then been found in most of the lake dwellings, and I am quite convinced that this is the true explanation.

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[1] The true nature of these objects, as it appears to me, has been fully shown; see notes on 'head-rests,' pp. 177-179 and 338.—[Tr.]

The most singular object in stone, however, is that drawn Plate CXLIII. fig. 1. It is a piece of porphyry, shaped like a pulley; it is as regularly rounded as if it had been made by a lathe, and leads to several inquiries. First, we may ask how it was possible, with such imperfect tools as we see before us, for so very hard a material to be so admirably manufactured? Secondly, to what use could it be applied? With respect to the workmanship, it is evident, when closely examined, that the stone has been brought into its present form by grinding. But what labour and trouble this must have caused! If the celts of flint and hard serpentine, &c., give us an idea of the dexterity and patience of the primitive workman, the labour and skill required by the specimen before us is perfectly astonishing. I have not yet succeeded in determining its use. My antiquarian friends differ exceedingly in opinion respecting it. I have not found anything like it described in the works on Gallic or German antiquities. Since this specimen was found the investigations in the lake dwellings have brought to light similar objects, though not perhaps of equal workmanship, and antiquaries now call them 'slingstones;' but this term must be considered as conventional, for it can hardly be imagined (at any rate with respect to our specimen) that so much labour would be bestowed on objects which very probably might be used only once.[1]

4. *Glass.*—The only object found of this material was a bead of a whitish-blue colour, just like those which have been found in graves and Roman settlements, Plate CXLV. fig. 2.

5. *Horn and Bone.*—Horns of the roebuck were occasionally met with, more or less worked, and antlers which had been used for tools; there were also a number of fossil sharks' teeth, which had been found in the 'molasse,' and perhaps had been used for piercing tools. But the most convincing proof of the small advances which had been made in civilisation by the settlers at Ebersberg is given by the lance-point of bone found in the rubbish, and drawn Plate CXLIII. fig. 11, and Plate CXLV. fig. 6. When we look at this implement, we are almost compelled to believe that the settlement at Ebersberg was founded in the very earliest ages, when Switzerland was first inhabited. For, in the first century of our era, the Gauls,

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[1] See the notes on pages 140 and 141.

according to the accounts of Greek and Roman authors, were so far advanced as to understand thoroughly the employment of metals for every purpose of war, husbandry, and household economy; they had also abundance of iron (which is entirely wanting at Ebersberg) and they had given up both making and using implements of bone.[1]

6. *Bronze Implements.*—The objects which fall under this head are the following. Fragments of two knives, Plate CXLIII. fig. 12, and CXLV. fig. 10; a few dozen hair and clothes pins of different forms and sizes, some of which are drawn Plate CXLIII. figs. 13, 14, 18, and 19, and Plate CXLV. figs. 7, 8, 9, 14, 15, and 16; several wires neatly worked round in a spiral form, Plate CXLV. figs. 13 and 23; several little chisels, Plate CXLIII. figs. 15, 16 and 17; a finger ring, Plate CXLV. fig. 18, and an earring, fig. 19, and a number of bands and rings, Plate CXLIII. fig. 4, ornamented in various ways; and, lastly, an arrow-head, Plate CXLV. fig. 25.

No implement of iron of any kind was found here in either of the excavations, and nothing which had the appearance even of oxidation; in fact, no metal was found but bronze, and of this the quantity was so small that the weight of the whole hardly amounted to many ounces. No particular skill in the workmanship or elegance of form is to be observed in any of the bronze implements.

7. *Animal Remains.*—According to the determination of Professor Rütimeyer, the bones found at Ebersberg belong to the following species. 1. A large species of cow. 2. The pig. 3. The sheep. 4. The goat. 5. The stag. 6. The roe. 7. The dog or wolf. 8. The chamois (?).

In conclusion, I may remark, as a singular fact, that the pottery found here was scattered about in such a way that the single fragments belonging to one and the same vessel were seldom or never found together, a fact which would lead one to suppose that these things might have been intentionally broken to pieces, and thrown away, if we had not observed that the bones of animals were scattered in a similar manner. There was, however, clearly no particular place fixed on for a rubbish heap, and broken vessels lay about the house, just as is the case amongst all people who are but little civilised.

The presence of bronze implements may possibly have some connection with a hostile attack and a violent destruction of this settlement, for what was there to hinder the emigrants, if leaving peaceably, from taking these small things with them? But even the very minuteness of these objects, only discovered by us after very careful search, would render it almost impossible for the inhabitants to find them after they had been lost in the dirt surrounding the huts. It is rather a matter of wonder that so few things of the kind should have been found in the excavation of an area of 4,500 square feet. Besides this, no very large quantity of ashes or charred wood occurred here, and no human remains, and consequently no indications of a sudden destruction of the settlement by the hand of an enemy.[1]

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[1] This argument appears to me to lose all force when we reflect on the number and variety of objects made of bone, horn, ivory, and wood in common use amongst modern nations far advanced in civilisation.—[Tr.]

G. VON ESCHER VON BERG.

Eigenthal.

II. BURG (ANCIENT CASTLE) NEAR VILTERS.

Vilters is in the Canton of St. Gall, not far from Ragatz and the celebrated baths of Pfeffers. The rocky eminence called Burg Vilters lies about half an hour's walk up the mountain which overlooks the plain: it is on a mass of rock 30 or 40 feet high, and very difficult of access. It commands a wide view of the whole valley of the Rhine, and from it may be traced the course of the Roman military road leading from Coire to Sargans. It is very evident that a Roman watchtower (specula) was placed here, from the numerous Roman antiquities which have been discovered. They consist of remains of walls, tiles, and a number of bronze and iron implements belonging to that period, such as rings, needles, buckles, styles, chains, knives, lance-points, and coins, down to Constantine the Great. But the *first occupation* of the place occurred at a much earlier period, and the settlement then made was contemporary with the lake dwellings, as may be proved from the numerous antiquities found here. Excavations were made at the top of the rock in the year 1862, when flint saws, corn-crushers, stone spindle-whorls, stone celts, bone chisels, a half-moon ornament, and bronze arrow-heads were met with, all of them objects precisely similar to those found at Ebersberg. The portion of a floor made of stamped clay seems also to have been a remnant of the older settlement.

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[1] In Sir John Lubbock's very interesting work, lately published, it is mentioned p. 128, that the settlement of Ebersberg was built on piles. Is not this a slip of the pen? for no mention is made of piles in the two reports by Mr. Escher von Berg, the substance of which is given above, and which I am informed contain the only information as to this settlement. It may possibly have been built on piles, but it appears to me there is no evidence to prove this, and as the ground was well beaten down, and coated with clay and gravel to make a flooring, this fact seems to militate against the idea of the houses having stood upon piles.—[TR.]

III. UETLIBERG.

In the time of the Romans there was a building on the Uetliberg near Zürich, the highest point of Mount Albis, as is proved by the Roman tiles, pottery, tools, and coins found there. There was also a castle here in the Middle Ages which was destroyed at the end of the thirteenth century. But this place must have been inhabited long before this, quite in the early ages, in the period of the lake dwellings; for at a depth of four or five feet fragments of pottery exactly like those of the lake dwellings were found, together with a very large number of the bones of various animals which had been intentionally broken, as well as implements of various kinds.

A few of the antiquities found here are drawn on Plate CXLVI. Fig. 1 is a fragment of red pottery with very coarse ornamentation, apparently made by the nail. Fig. 2 is another fragment with rather a peculiar ornamentation: two lines or furrows roughly scored with smaller lines, and interrupted with bosses placed at irregular distances, seem to have gone round the vessel; from the coarseness and irregularity of the work it almost has the appearance of having been done by the worn-out point of a piece of bulrush or some other reed; the colour of this fragment is black. Fig. 3 is a bronze chisel; the section is oval. Fig. 4, a stone celt of the usual form. Fig. 5 is a bone-piercer. Fig. 6 may perhaps be considered as a bronze pin. Fig. 7 shows four little peculiar bronze ornaments; two of them are perforated at each end, and the other two are not perforated at all: they are not of twisted wire, but of solid bronze filed so as to have that appearance. Fig. 8 is a small bronze wheel; it may possibly be of a later age than the other things drawn on this plate. Fig. 9 is evidently the handle of one of the bronze crescents found at several settlements in the western lakes. Fig. 10 is a small ornament apparently of solid bronze, wrapped round with bronze wire.

IV. WINDISCH.

At this place (the Roman Vindonissa) where Mr. Laupper has made extensive excavations, and has uncovered ground to the extent of many acres, numerous remains have been found both of earlier and of Roman date. The most interesting discovery, however, which he made was that of a clay flooring several feet below the surface, and of which he opened a part for me to see when I went there on hearing of what he had found: he assured me that he had repeatedly met with similar flooring. At the limits of this flooring there was rather a long heap of the pieces of clay coating of the huts with impressions of the wattlework, just like that at Ebersberg. Mr. Laupper had satisfied himself that this heap lay in a circular form and not in straight lines, the included space being covered over with charcoal and ashes. On the outside of this heap of clay coatings there was found a great quantity of Celtic pottery, both whole and broken; bones of pigs, horses, and, as he believes, of men; also bronze clasps, rusted iron implements, &c. Amongst other things which I saw myself were some portions of the clay coating of the hut, coloured white and red; as at Ebersberg one side of these clay fragments was hard and had changed colour by heat, and the other side was soft.

A few of the earliest antiquities found here are drawn on the lower half of Plate CXLVI. Fig. 11 is a flint knife. Fig. 12 a flint scraper. Fig. 13 a large and strong stone celt. The sections of these three implements are shown at the sides of the figures. Figs. 14 and 15 are the regular well-known corn-crushers; and Fig. 16 is a bear's tooth with the fang perforated, probably intended for an amulet or ornament.

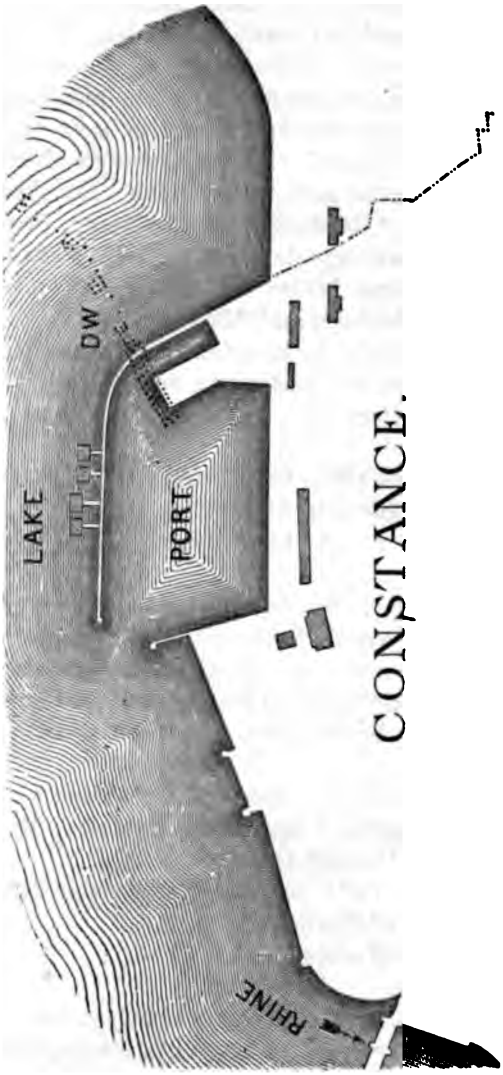
As the present work refers more especially to the lake dwellings and not to antiquities in general, probably these few instances will be sufficient to enable the reader to compare the settlements on the mainland with those in the lakes, and also to convince him that both descriptions were the work of one and the same people.

LAKE DWELLING IN CONSTANCE. (WÜRTTEMBERG.)

BY MR. LUDWIG LEINER.

FOR a series of years, since the first lacustrine antiquities were found at Wangen in our district, nearly every winter, when the water is at its lowest, new discoveries have been made on the shores of the Unter See, the Ober See, and the Rhine, which go back to an age more than four thousand years ago, when our ancestors worked with celts and chisels of stone, and used saws, arrow and lance heads made of flint or jasper—needles and chisels made out of the antlers of the great red deer, the tusks of boars, or the horns of the ox or the bison—when they crushed between stones their scanty measure of corn, and in order to protect themselves from the wild beasts or the attacks of hostile tribes they built abodes in the lakes and lived on platforms fixed on piles. At no great distance from here several pile settlements have been discovered, viz., Lützelstetten, Nussdorf, Maurach, Mammern, Allensbach, Markelfingen, Wallhausen, Ermatingen, and Reichenau, and very lately another; also at Escheuz, where the Romans built a bridge over the Rhine. The antiquities found in these various stations may be examined in the town museum of the 'Rosgarten.' But there are always people ready to distrust these silent witnesses of the past, and many have especially doubted whether the neighbourhood of Constance ever was the site of a lake dwelling; but the occasional discovery here of stone celts and flint chips seemed to indicate this. Still up to the present time it had been impossible to substantiate the fact of an undoubted pile-settlement of our ancestors at Constance. But this has now been done. In the 'Rauenegg,' where the enlarged harbour has been made (see the annexed woodcut), there are several rows of ancient oak piles and cross timbers running in a southerly direction towards the Kreuzlingen shore: these run in a totally different direction from the more modern piles of our present city. Amongst these ancient piles, hidden in the lake mud, and also especially in the shelly beds, may be found fragments of pottery, and jars and dishes, burnt a grey, blackish, or yellowish colour, and ornamented like the old Celtic or old German pottery. The ornamentation consists of a simple repetition of dots, lines, and triangles. Together with the pottery were found the characteristic loom-weights and spindle-whorls and portions of the clay covering of the huts—exactly the same things as have been found in abundance at Lützelstetten.

FIG. 43.



I wrote the above at the beginning of the excavations. Everything has now been proved, and all the particulars respecting our settlement have been made clearer by a careful examination of the antiquities discovered. The earthenware vessels from Lützelstetten, Wangen, Mammern, and Oberstaad are rough and made by the hand alone, while most of those found at 'Rauenegg' in Constance—at least the smaller ones—exhibit more undoubted evidence of the potter's wheel. They are generally of elegant forms, sometimes recalling the shape of some of the Egyptian vessels. Professor Desor called them the 'forms of the bronze age,' when he saw my collection.

The place where the antiquities which I am about to describe were found, in the 'Rauenegg' at Constance, lies considerably below the present average depth of the lake, so that they appear to date from a time before the Rhine had opened a passage through the Fläfcherberg and filled up the lake hollow.

It may not be amiss to mention that I have lately obtained from the gravel pits of Constance a nearly perfect skull of the bison and the antlers of a reindeer: but these belong to a different age.

The three Plates CCI., CCII., and CCIII. contain the drawings of some of the most interesting antiquities discovered at Constance. As I found them myself, I can vouch for their being genuine.

Plate CCI., Fig. 1, is a broken hammer of serpentine, which had a hole for the handle in the middle.

Fig. 2 is the 'core' or central portion remaining from the boring, showing first that the boring began on both sides, and secondly that the boring tool had been a cylinder of some description.

Fig. 3 is the half of a perforated serpentine hammer.

Fig. 4 is the half of a serpentine hammer; the boring has been begun but not completed.

Fig. 5 is the half of a perforated serpentine hammer.

Fig. 6 is a celt of diorite.

Fig. 7 is a celt of serpentine.

Fig. 8 do. do.

Fig. 9 is a small celt or scraper of serpentine.

Figs. 10 to 14 are various forms of flint implements.

Plate CCII. All the specimens drawn on this plate are of grey earthenware, and they are half the size of the originals.

Figs. 1 and 2. Spindle-whorls.

Fig. 3. A jar with two handles.

Fig. 4. An ornamented vase.

Fig. 5. A fragment highly ornamented.

Fig. 6. A small cup with a handle.

Fig. 7. A pot or pipkin without a handle.

Plate CCIII. The specimens drawn on this plate are also half the original size.

Fig. 1. An ornamented plate of earthenware.

Fig. 2. The neck of an earthenware vessel with twelve lines running round it. Each of these lines has a perforation so arranged that the line of holes runs diagonally.

Fig. 3. Ornamented pottery.

Fig. 4. Do. do.

Figs. 5 and 6. Ornaments of bronze.

Fig. 7. Bronze pin.

Fig. 8. The 'drop' ornament of a cup. (Glass?)

Fig. 9. Portion of the broken edge of a plate of light green glass.

Fig. 10. Part of the border of a plate of bluish-green glass.

Thus we find at the 'Rauenegg' in Constance, implements of stone, bronze, earthenware, and glass, all together. The ornamentation is carried to a high degree, and patterns are here found on earthenware which formerly used to be considered to belong exclusively to implements of bronze.

Although several loom-weights were found, we never succeeded in finding any specimens of woven cloth: it is possible that the place where they were to be found had been dug out before any attention was paid to the matter, or they may lie on the shore covered with mud. The land near where the pile dwelling is situated is constantly encroaching on the lake, from the quantity of alluvial matter brought there by the water.

Ludwig Leiner.

THE LAKE DWELLING OF SCHUSSENRIED IN THE BASIN OF THE FEDER SEE. (WÜRTTEMBERG.)[1]

BY E. FRANK.

THIS lake dwelling is of such extent that excavations may be carried on here successfully for a series of years. As yet but little has been done, but that little is full of interest.

The present Feder See is now what is called a moor or peat lake, extending over nearly 550 English acres, but in former times it had a much greater surface, as may be clearly seen from the ancient banks. It was bounded on the east and west by Tertiary strata, on the south by glacial gravel, and on the north by the Jura formation of the Swabian Alps. See Plate CXCVI.

Our lake dwellings are situated in what is called the peat moor of Steinhaus, rather more than a mile and three quarters north of Schussenried, near Eichbühl and Schienenhof, not far from what is acknowledged as the south-eastern bank of the ancient Feder See, and quite near to the bed of the ancient Feder brook.

The inhabitants of the settlement could reach the mainland by two different ways; either by going southwards, to what is now the government forest Riedschachen, a moraine of an ancient glacier, distant from the settlement about 380 yards; or towards the east, where the present government forest Oedenbühl lies, and in all probability to Schienenhof, which is about 620 yards distant, and which is situated on a kind of Tertiary loam or clay, from which tiles are made at the present day.

How the inhabitants in those days reached the mainland, whether by bridges, or by boats, often called 'dug-outs' (or 'Einbaums'), cannot now be ascertained.

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[1] This account is taken from a paper which was read by Mr. Frank at the meeting of the Association for Natural Science in Württemberg, and printed in their volume for 1876. It is generally understood that Mr. Frank is about to publish the results of the excavations since that time, together with drawings of the specimens. The two plates of objects given in the present work are from tracings kindly sent by Mr. Frank to Dr. Keller.—[TR.]

So far, however, is certain, the lake dwelling was erected on a natural rise under water, probably made by what the Feder brook brought down; this seems evident from the greater thickness of the surrounding peat.

The first bed found on the gravelly lake bottom is about 15 inches thick, and consists of what is called 'meadow chalk'[1] (a loamy or argillaceous calcareous deposit, 'weisser grund,' blancfond); it is in a measure gelatinous and snow-white, and in the upper part it passes into a grey marble-like substance. In this bed, I beg to remark that no trace of any human workmanship has yet been discovered, which is probably a proof that the lake-dwelling colony was not founded till after this bed of chalk had been completely deposited.

On this lies the actual relic-bed, on the average 5 feet thick, which ceases at the highest horizontal layer of the timberwork, and is then covered by peat about 6½ feet in thickness.

The relic-bed consists (besides the timberwork of which I will speak afterwards), of a yellow, green, or brownish peaty loam; it is also somewhat tenacious in structure, and in some parts smells strongly of sulphuretted hydrogen gas. At the very bottom of the relic-bed, but immediately above the 'blancfond' lie a number of stags' horns and bones, but implements are more rare, a fact which seems to confirm the supposition that the colony was founded when the peat lying on the 'blancfond' had begun to grow, and which continued to increase more and more during the existence of the settlement, till at last it was made uninhabitable, although repeated attempts had been made to build fresh huts and extend the colony northwards where the water was deeper, but all was in vain. In the middle of this part of the relic-bed, between the lowest tier of horizontal timber and the bed of 'blancfond,' many fragments of pottery are found, with the bones; but it is above and between the horizontal layers of timber, and chiefly in the immediate neighbourhood of the upright piles, that implements of all kinds are met with, of flint, stone, horn, bone, teeth, and wood; also earthenware vessels and spoons, quite perfect; abundance of charcoal, hazelnuts, corn, &c., which shall be described hereafter.

With respect to the construction of the dwellings, I would in the first place remark that this which now lies before us is one of the most difficult pages to read in the book of prehistoric civilisation. For apparently our lake dwellings were inhabited for a great length of time, and constantly needed repairs, and the inhabitants, on account of the continual growth of peat, were obliged again and again to erect higher platforms one over another. Hence the explanation of the lake dwelling became very difficult, and almost every square yard excavated was so varied in character that each day's work seemed to throw less light on the matter. Under these circumstances I determined to take with me plans, sketches, and drawings, and to make a regular lake-dwelling journey, and more especially to have a personal interview with the learned and friendly Dr. Ferdinand Keller, of Zürich, to whom we owe so much for his reports on these settlements in Switzerland, published by the Antiquarian Association of Zürich. It is well known that there is very little difference in the mode of construction between the lake dwellings of the earliest or stone period and those of the later ages, that of bronze and that of iron.[1]

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[1] This is no doubt the white shell-marl so characteristic of all fresh-water deposits.—[Tr.]

Of more than 200 lake dwellings now known, by far the greater number belong to the regular pile-dwellings, that is, the piles had been driven down in rows, sometimes in regular order and sometimes apparently in confusion. They are from 7 to 13 feet in length, and seldom more than 4 inches in diameter; they had been pointed at the bottom, in some cases by means of fire, but they varied much in the degree of sharpness. They were generally upright, and had been driven into the lake-bottom more or less deeply, according to the nature of the ground. To the tops of these upright piles, which were nearly all of equal height above the water, the horizontal timbers were attached; they were chiefly of round wood, perforated at the ends, and fastened with wooden pegs, or in some other way; thus the platform for the huts was made. These are what may be called the regular pile-dwellings.

The 'fascine dwellings' are much rarer; they are like those of Wauwyl and Niederwyl in Switzerland. The substructure consists of layers of bundles of wood laid parallel with each other, and alternating with others placed at right angles. The whole was then sunk down by its own weight, or with loam or gravel, till the upper portion was a little above the surface of the water. The lowest bed of these fascines rests immediately on the lake bottom. The upright piles found between the horizontal layers, but which do not go down to the actual lake-bottom, were intended not as supports for the platform but to keep together the different parts of the substructure, in fact they served as spikes or pins to prevent the horizontal bulging of the whole structure. These fascine-dwellings could only have been used in the smaller lakes. The waves which in the larger lakes dash under the regular pile-dwellings without injuring them, would soon have torn a fascine-dwelling to pieces. Notwithstanding its apparent simplicity the fascine construction does not appear to be older than the regular form, and it may be proved that the state of civilisation of the fascine-dwellers exactly coincides with that of the inhabitants of other settlements of the stone age.

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[1] The piles of the bronze period were usually sharpened with bronze axes; those of the stone period were round timber, with the bark still on, and were often sharpened by fire. The iron and bronze age platforms had the timbers mortised together, and the platform of boards squared and better fitted.—[Tr.]

A third construction has been suggested, but, as I believe, never proved to have existed, namely, that of fixed floating dwellings, made of small branches and brushwood, and secured in one place by upright piles. This construction may be dismissed as ideal.

If we compare the structure of the Schussenried lake dwellings with that of the other two modes above-mentioned, we shall come to the conclusion that our settlement was not a fascine-dwelling; for the lowest beds of timber never rest upon the lake-bottom. On the contrary, there is between the two on the average from 4 to 5 feet of regular relic-bed, containing a mass of implements and bones of all kinds; and then again most of the upright piles, which in general are about 2¼ feet apart, 4 inches thick, and 10 feet long, had been sharpened by stone implements, and in some cases by fire, and had then been driven about a foot deep in the actual lake-bottom.

Unless, therefore, we could venture to suppose that in our case a new and unheard-of mode of construction had been adopted (and this supposition would be as bold as it is unsupported), nothing remains for us in the present case but to assume that these abodes were made in the usual mode of pile-dwellings. The length of time that the settlement was occupied implies that great changes must have been necessary, and unless we consider that the horizontal layers of timber (in some cases consisting of eight beds alternately parallel and crosswise) were laid down in consequence of these changes; that is, according to circumstances, it would be difficult to explain how piles, relatively so weak, could have supported such a weight. It is also a striking fact that *all* the upright piles do not reach the lake-bottom, for many of the secondary ones have their lower ends in the relic-bed. It must also be borne in mind that they are not all of the same height, but some are higher than others in the horizontal layers of timbers, and that they are not fastened to them either by tenons and mortises or in any other way; nay, in the area yet excavated, I only found three cases in which the cross timbers rested *immediately* on the heads of the vertical piles. On the contrary it is frequently found that close to an upright pile three or four others had been driven in at a slight angle, so as to form a kind of fork for the horizontal timber to rest in, thus becoming a very decided support for the platform.

Again it must be remarked that the timbers forming each horizontal layer, whether of round wood or split boards, were always carefully cemented with washed blue clay, both with each other and with the vertical piles.

The horizontal layers vary exceedingly. Sometimes they consist of unhewn timber, the bark of which is so fresh that it might have been cut down only a few days ago. Sometimes two parallel beds of unhewn timber interchange crosswise with two parallel beds of hewn or split boards, about 16 inches wide and 7 or 8 inches thick, of which the sides turned towards the water are frequently charred, and then again round wood and boards are frequently intermixed without any regularity whatever; but all the joinings were carefully cemented with clay as above-mentioned, and not only this, but every two beds of the horizontal layers were also cemented together. In many cases between two of the horizontal layers there was a peculiar relic-bed, and it was here that the more perfect earthenware vessels were found embedded in the fine clay, together with implements of every kind, charcoal, hazelnuts, corn, &c., which is a satisfactory proof that the various platforms were not made at the same time, but had been erected gradually as they were wanted, when the former huts had become useless, either from fire or any other cause. A general view of a large portion of the settlement, when first excavated, is given on Plate CXCVII.

Whether the huts were rectangular or circular, whether they had a common platform, or were built separately on small portions of it, with narrow channels between them, and were only connected together by bridges or some similar arrangement, what size they were, &c., can only be made out by the exercise of fancy; but thus far may be ascertained with certainty, that the posts of the huts were covered with clay, and, as many pieces of birch bark have been found rolled up, we may imagine that in some way or other it had been used as a covering for the huts, but it is singular that no reeds, rushes, brushwood, or moss were found here, which occurred so abundantly at Wangen, and probably served for covering the roof or for bedding.

Dr. A. Tscherning, of Stuttgart, has kindly examined the different kinds of wood microscopically, and the result is most remarkable and interesting, for not a trace of the wood of the pine family (*coniferæ*) was found amongst the pieces which were sent to him; and the white alder (*Alnus incana*) was by far the most abundant of all, which evidently indicates a subalpine forest flora. After the white alder the following species were found, and they are placed in order according to their abundance or rarity, the more common being mentioned first. The ash (*Fraxinus excelsior*); black alder (*A. glutinosa*); white birch (*Betula alba*); oak (*Quercus robur*); red beech (*Fagus sylvatica*); willow (*Salix fragilis* and *S. caprea*); aspen (*Populus tremula*); maple (*Acer platanoides*); hazelnut (*Corylus avellana*); elm (*Ulmus campestris*); one of our common native trees, the hornbeam (*Carpinus Betulus*), is wanting; also the lime tree (*Tilia parvifolia*); and the wild apple and pear trees (*Pyrus malus* and *communis*); none of the fruit of the latter species were found here. Very thick stems occurred of the following species: the alder, the ash, the oak, the beech, the aspen, and especially of the willow.

Before describing the implements it may be well to mention that they were never found heaped together, but occurred singly throughout the relic-bed.

The pottery takes the first place amongst the specimens. And I may here remark that I have seen the more important collections of lake-dwelling antiquities in East Switzerland and the Lake of Constance, and I must confess that I found my first conviction fully borne out, namely, that the pottery of our lake dwelling is of a peculiar kind. I saw everywhere earthenware vessels more or less coarse, but I saw none of the pretty little jars, bowls, and spoons which have been sometimes dug up quite perfect here. For instance, little jars are found from 2 to 5 inches high, of a great variety of forms, generally with one handle, never with two, and very rarely without any handle at all; the ornamentation is very varied, and consists of lines and dots combined; they are always imperfectly burnt, sometimes they are of a reddish aspect, sometimes spotted with soot colour, and occasionally vessels of a similar form are coloured as if with graphite. From the numerous marks of the hand visible upon them, it seems clear that they were all made by the hand alone without the aid of the potter's wheel. The material used is sometimes a clean washed clay occasionally mixed throughout with a quantity of fine charcoal dust, or with coarser white grains of quartz. As before mentioned the best specimens of earthenware were found near the settlement.

The large pots and dishes are not ornamented at all; they are generally found in fragments. The pots mostly have four perforated knobs placed in a row round the bulge, Plate CC. fig. 5, and Plate CXCVIII. fig. 7; these vessels were of various sizes up to 12 inches high and 10 inches in diameter, two have handles, Plate CC. fig. 4, and Plate CXCVIII. fig. 1, and probably were pipkins. They are commonly very coarsely made, and in general the clay is mixed with great angular grains of quartz, pieces of mica, and even of charcoal. In many cases they are not blackened, but have a reddish or yellow brown appearance. Those which are blackened are made of a different material, viz., a very fine clay mixed with charcoal dust and small plates of mica.

It appears to me doubtful whether these finer and larger vessels could be made by the hand alone, at least, very clever potters have assured me that a wheel or some similar kind of machinery is absolutely necessary to turn out vessels with the sides so proportionably thick, and of such a symmetrical well-bulged form; or, is it possible that our lake-dwellers were more clever at their work than our modern potters?

The ornamentation consists almost entirely of points or dots, and straight lines. I only saw curved lines in two instances. The work was probably done by small flint knives, or by bird's bones pressed into the clay; and the ornaments run in zigzag lines round the bulge and the neck, but their combination is so varied that a complete set of patterns of various designs might easily be copied from them, Plate CXCVIII. figs. 2, 3, 5, 6, 8, and 9.

There are no vessels like plates or bottles, neither are there any with a narrow long neck (one with a wide neck is drawn Fig. 4), or with flower-like ornaments, nor is the red under-tint found here, and I have never seen the furrows of the ornamentation filled in artificially with chalk. But many of them are beautifully ornamented, as may be seen from Plate CC. figs. 2 and 3. No examples have been met with of those earthenware vessels which have the base rounded or pointed, and which had to stand in clay rings, such as are found rather plentifully in the lake dwellings of West Switzerland.

The quantity of fragments of pottery is quite astounding. Several of those who watched the excavations, came to the conclusion that the settlers followed up the art of pottery with such skill, that probably they turned their wares into objects of barter, and may have known something about the division of labour. At all events, in this branch of industrial art they stand much higher than in the manufacture of arms and implements of stone and bone, while in the much earlier reindeer period of France the contrary is well known to have been the case.

Before we dismiss this part of the subject, some earthenware spoons ought to be mentioned, remarkably well made; also an implement like a spindle-whorl, but which from its extremely coarse manufacture may have been a net-weight, and this is more probable, as no products of weaving or tanning, such as are found at Robenhausen and Wangen, have been found here, although the manufacture of flax was certainly known, as may be proved by our having found several eyed needles, and also a kind of netting needle made with two prongs out of stag's horn.

Lastly, I consider those pieces of pottery which have notches or incisions on the opposite sides to be net-sinkers. They are very common here.

The implements and weapons found here are of stone, bone, stag's horn, and wood; not a trace of bronze or iron has been seen.

As a general rule these relics agree with those found in the oldest stone-age settlements, such as Moosseedorf, Wauwyl, Robenhausen, and Wangen; still there are some few things which ought to be mentioned as specialities.

Of flint implements, two knives (or what may be called so) are worth notice, one of them is 6½ inches long, and 1½ inches broad; another has still the asphalt adhering to it by which it was fastened into its hafting, Plate CXCIX. fig. 7; another flint knife is shown, fig. 13.

A series of arrow-heads, Plate CXCIX. figs. 5, 6, and 9, sawlike implements, and scrapers, Fig. 8, indicate great skill in working flint. Whether the raw material came from the white Jura of the Suabian Alps or was imported, I do not venture at present to decide, but the great variety in colour is worthy of remark; it varies from white, dark red, wax yellow, dull grey brown, to lilac, with all possible transitions and shades. The only coloured flints I have not observed are the dark glistening flint, such as is generally found at Wangen, of which Mr. Caspar Lohle was kind enough to give me specimens, and the flesh-coloured flint of Thayngen.

The stone axes, hatchets, and celts consist, in general, of different kinds of greenstone, and more rarely of limestone and serpentine. Plate CXCIX. figs. 10 and 12 will give some idea of the form. No nephrite was found; perforated stone weapons are very rarely found here, in fact, as a general rule the stone weapons are not abundant, but those which are met with are well ground and polished; they vary much both in size and weight, the largest which I saw weighed nearly 1 lb. English, the smallest about ⅜ of an ounce; smaller stone celts and chisels are often found in these haftings of stag's horn.

A large lance-head ought to be mentioned, which weighs about 1½ lbs.; and a hammer or mallet, which weighs 4 lbs. The latter had evidently been used for driving in the piles by hand; both were made out of a stone like diorite.

The circumstance that the stone weapons here resembled those of Wangen, with the exception of being very rarely perforated, coupled with the further fact that the implements of our lake-dwelling inhabitants, with the sole exception of the pottery, never are adorned with even the most simple ornamentation, seems suggestive, if we consider that even in the cave of Vypustek, in Mähren, very fine polished and perforated stone weapons were found together with coarse and fine pottery both ornamented and unornamented, associated with a great number of the teeth and bones of the cave-bear and the cave-lion.

The cave-dwellers of the reindeer period in France who inhabited the Dordogne Valley, and also the inhabitants of the Kesslerloch Cave, near Thayngen, in the canton of Schaffhausen, who most certainly are older than the lake-dwelling settlers, possessed even at that time great skill in drawing and engraving on pieces of slate, of brown coal, and of reindeer's horn; but on the other hand, the first-named race had hardly advanced further in the ornamentation of their pottery than their Belgian contemporaries, as may be seen from the most valuable remains of the potter's art in the reindeer age (the great vessels from the Trou du Frontal); and the inhabitants of the Kesslerloch Cave appear to have had as little idea of the art of pottery as of making stone celts and worked flints.

Most certainly no comparison can be drawn between the Schussenried stone weapons, and the beautiful axes, hammers, arrow- and lance-heads found in Denmark, Belgium, and in the peat moors of the Somme, and in England. Nay, even the implements of the ancient inhabitants of Switzerland, so far as they belong to the pure stone age, are both more perfect and numerous.

Of stag's horn, in the first place may be mentioned the haftings for the stone celts and chisels, Plate CXCIX. figs. 3 and 4, but they are without any elegance and very simple; for instance, the rose piece itself was not used for this purpose, as at Robenhausen and other settlements. These haftings are common and are found in all stages of manufacture, as well as broken specimens and those which had proved failures.

Some hammers or implements made out of the rose piece of a stag's horn, sometimes with an oblong hole for a handle, and sometimes with a round one, Plate CXCIX. figs. 1 and 11, and which were sharpened at the end, I consider to be agricultural implements, as also an implement like a hoe, quite perfect, made of the same material; if a wooden handle were now fitted to the latter, it might be used at the present day for digging up the ground, if it were not too stony.

Daggers, Plate CXCIX. fig. 2, lances, chisels, and the netting-needle already mentioned were also made of stag's horn.

The long bones of the stag were made into chisels and pins, with or without an eye, and pieces of the ribs carefully sharpened were made into knives and scrapers.

The tusk of the lower jaw of the wild boar was made into a knife of extraordinary sharpness.

Amongst the implements of wood were a charred cooking-spoon, haftings for smaller stone celts, as at Robenhausen, portions of very well made handles for celts or for agricultural tools. These were made of ash. A block of wood like an anvil (shoemaker's last?), fragments of wooden dishes made of elm wood, pieces of oak boards with oblong holes, use unknown—these are rare; and, lastly, a wooden mallet for beating down the floor, with a tolerably sharp point at the top, below which is a natural branch at an acute angle, which answered for a handle, so that it had exactly the same form as those in use at the present day.

Some few things still remain to be mentioned.

Omitting some objects which can only be considered ornaments, we may mention certain portions of a rope $\frac{4}{10}$ inch thick, not made of flax, but of the bast of the lime tree, as having great interest; this rope appears to have been twisted out of two strands. In a broken jar there was found a greyish-black finely-powdered substance, but baked into a mass: it has the exact appearance of graphite, such as our potters use to blacken their stoves. I am convinced that this substance, probably made of fat and charcoal dust rubbed together, was exclusively used for blackening the better kind of earthenware vessels; at least I succeeded in imitating the tint by using it on uncoloured pottery. We have a complete analysis of this substance before us, for Professor Nies, of Hohenheim, has examined it both chemically and microscopically, and finds it to consist of a very pure carbonate of lime, mixed with but little sand and with a bituminous substance.

Another substance varying between brown and bright red was found partly in a crude mass and partly in powder.

That first-named appears to be the common red oxide of iron, or possibly a very ferruginous clay slate. Dr. Ostermeyer, of Biberach, undertook to examine the latter, and he finds it to be a red 'bole,' consisting of oxide of iron, with earthy clay.[1] It seems to me unlikely that this colouring matter was used, as is frequently imagined, to paint the bodies of the settlers; and I rather think that it was used for polishing the weapons, as what is called 'English red' is made use of at the present day.

Another highly interesting specimen is a kidney-shaped mass of asphalt, 5½ inches long, 4 inches broad, and nearly 2 inches thick, weighing nearly ¾ lb., not at all broken, which seems an unmistakable proof that our lake-dwellers carried on commercial exchanges. Another is a perforated bright red bead like coral, the nature of which has not yet been investigated. This leads me to the same conclusion.

Not to mention numerous pieces of wood, flint flakes, pottery, and charcoal, there were also found mealing-stones, corn-crushers, grinding and polishing stones of very hard crystalline limestone, and many other specimens of different kinds, the use of which is unknown; abundance of charred wheat, occasionally together with fragments of the large earthenware vessels in which it was kept; acorns, beechnuts, and numerous hazelnuts, also a seed which I do not think I have seen in any collection, not even in that of Mr. Messikomer, of Robenhausen.

Professor Hegelmaier, of Zubingen, has had the kindness to examine the vegetable remains which were unknown to me, and to send me the following list, but unfortunately he is not able at the present moment positively to determine the seed in question.

According to Professor Hegelmaier, the wheat found so plentifully is a large-grained variety of *Triticum vulgare*. Linseed (*Linum usitatissimum*, Heer) is more rare. There are no seed-vessels of it, nor are there any seeds of the raspberry (*Rubus Idæus*).

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[1] Bolus (in English 'bole') is the term given by the Swiss miners to the coloured marly substance in which the 'Bohn-erz,' or pisolitic iron ore, is found in the beautiful Münster Thal. It is from this 'bohn-erz' that the best Swiss iron is made.—[TR.]

It was probably by chance that the *Hypnum commutatum, Hedw.*, and *Anomoden viticulosus*, B. S., came into the lake dwelling: they are now the most common large mosses of our forest. It may be that in those times they might have been used for some technical purpose.

Before we proceed to the animal remains it may be well to take a rapid glance at the various things which are not found here, but which have been discovered in settlements of a similar age in East Switzerland and in the lake of Constance. The following is a list of those things which are not found at Schussenried, and yet occur elsewhere in lake dwellings. Not to speak of metal, we begin with nephrite, arrow-heads of rock crystal, glass beads, amber, portions of the loom, spindle-whorls, clay rings, fishing implements, platted leather and woven flax; seed-vessels of linseed, bread, apples, and pears, the droppings of cattle, sheep, and goats; pine-wood, or the brushwood of fir trees, rushes, and straw. It is to be hoped that further excavations will bring to light some of these objects.

With respect to the fauna, I would remark in the first place that this part of the subject can only be properly worked up by those who have all the necessary means of comparison at hand. What I have now to state, in order to complete this notice, I owe to communications from MM. von Krauds, Fraas, and Rütimeyer.

Four hundred and twenty-eight human bones were found, which have been examined and determined by Professor Fraas. There was one broken frontal bone, and a femur which had been gnawed by some carnivorous animal; the form was that of a small and weak type, and this appears to indicate that it belonged to a young man or a girl.

Amongst the wild animals, the stag (*Cervus elaphus*, L.) takes the first place. 259 bones were determined by Prof. Fraas, so that they formed about 60 per cent. of the whole; and yet they probably belonged to about 20 or 25 animals. The antlers were very large, and all of them had been worked with flint knives, the straight tines more especially had been hewn off; the curved parts, especially the brow antler, having probably been used for small haftings rather than for lances.

The roebuck (*C. capreolus*, L.) is very rare here; no trace of human workmanship is visible on its horns. Only 17 bones were found; and these, according to Prof. Fraas, indicate only a few individual animals. The wild boar (*Sus scrofa ferus*, L.) has left only 83 remains of bones, and these do not indicate more than 11 individuals, for they often correspond. Amongst these bones, however, are to be found those of unusually powerful animals, as well as those of very young ones. The tusks of the lower jaw were, as before mentioned, used for knives; those of the upper jaw as ornaments.

The bear (*Ursus arctos*, L.), which, as far as I know, has only been found in the lake dwellings of Moosseedorf, Wangen, and the lake of Baldegg, is very rare here also. About a dozen bones, which seem to correspond, indicate probably only one animal. No teeth of this animal were found.

The remaining animals may be mentioned briefly.

Wolf (*Canis lupus*, L.), 1 bone indicating 1 animal.

Fox (*Canis vulpes*, L.), a young animal (? young dog) 30 bones.

Lynx (*Felis lynx*, L.), 4 bones indicating 1 individual.

Bison (*Bison priscus*, L.), 6 bones indicating 1 individual.

As yet no remains have been found of the following characteristic animals. The urus (*Bos primigenius*, Boj.), the elk (*Cervus alces*, L.), the beaver (*Castor fiber*, L.); this last-named animal cannot exactly be called rare in other lake dwellings. The last seen in this district was probably shot at the end of 1839.

Of the domestic animals we have a perfect skull and the half of a lower jaw of the dog (*Canis familiaris*, L.), indicating two animals; of the ox (*Bos taurus*, L. *brachyceros*?); 10 bones indicate 3 individuals. On the other hand the marsh pig (*Sus scrofa palustris*, Rut.) seems to have been abundant. Of the sheep (*Ovis aries*, L.) one lower jaw, with milk teeth, and the end of a scapula, indicate one individual. So far no remains of the horse and the goat have been found.

As an appendix to the above we may mention the pelvis of the field hare (*Lepus timidus*, L.), which, as far as I know, has not been found in any other lake dwelling. A toothless jaw, probably of a marten, an ulna of the wild duck (*Anas boschas*, L.), an implement made out of a heron's bone, and lastly a few vertebræ of the pike and other fish. The great rarity of the remains of fish is certainly very striking, as numbers of backbones and scales are found in other settlements.

We have here given the whole fauna of this lake dwelling as far as it is yet known. It is decidedly a poor one, especially if we compare it with the list of animals found in the Cave of Kesslerloch, near Thayngen. It is to be hoped that further discoveries will enlarge our fauna.

If we ask, What brought this settlement to an end? I can only give a negative answer. It certainly was not burnt down, for the extraordinarily fresh appearance of the highest horizontal layers of timber immediately after they were laid bare led me to ask whether these lake dwellings had not suddenly and for ever been overwhelmed with water. Possibly the future may bring an answer to this question.

With respect to the relative age of our lake dwelling, from all that has just been said there appears to be no doubt that it is younger than the remains discovered at the Schussenquelle (Reindeer age) in Hohlefels, with the exception of the highest beds, younger than those of the Schelmengraben and Mähr Caves, and more especially younger than the remains found in the Kesslerloch Cave, near Thayngen. On the contrary it is older than the Danish Kitchenmiddings, and most of the lake dwellings of Switzerland and the Lake of Constance. At all events the lake dwelling of Schussenried, so far as it is known at present, belongs to the oldest period of the neolithic age, which is bounded as it were on one side by the period of polished stone implements, and on the other by the absence of the reindeer, the cave bear, and the mammoth. So that we may place Schussenried as of the same age as Moosseedorf, and perhaps a little older than Wauwyl, Robenhausen, Wangen, Nussdorf, Maurach, &c. Under any circumstances the settlement could not have been founded until after the melting of the Rhine glaciers in this district, and when the country had taken its present form.

The absolute age of the lake dwelling might be ascertained if we only could be assured of the time required to form a certain amount of peat. The matter would then simply resolve itself into an actual calculation; but as we have not data sufficient for this it is useless to attempt to reason upon them.

Plate CXCVI. gives a little map of the neighbourhood of the settlement; the ancient bed of the lake is shown with dotted lines; and Plate CXCVII. gives the greater part of the sketch of the dwelling published by Mr. Frank in his interesting account.

LAKE OF STARNBERG (ROSEN-INSEL), BAVARIA.

In June 1864 Professor Desor and his assistant discovered in the lake of Starnberg the remains of a lake dwelling of the stone age: it is situated on the left shore, near the little island called Rosen-insel, where the king has a summer palace. When this locality was carefully examined many objects of bronze were found, together with bones, horns, and a quantity of pottery of the usual description. But the specimens obtained here were not of any very great interest.

The above is an exact copy of the very brief notice of this lake dwelling in the first edition of this work. Since then a full account of the island has been published in the '*Beiträge zur Anthropologie und Urgeschichte Bayerns,*' Band I., by M. Sigmund von Schab, the government law officer at Starnberg: the reader is referred to this very careful paper for more exact particulars. For the purpose of the present volume, however, it may be sufficient to give a brief abstract, illustrated by a selection from the drawings of the author,—Plates CLXXVIII. to CLXXXIII.

Notes on the Lake Dwellings of the Starnberger See.

By M. Sigmund von Schab.

The lake of Starnberg is about 2,378 English feet above the level of the sea: its shape is rather long, the greatest length being about twelve English miles, and the greatest breadth between three and four miles. In the narrowest part it is little more than a mile broad. On the western side the shore is rather flat: on the east the hills are higher. The only island in it is Rosen-insel, which had been in the possession of a fisherman's family for six generations, till in October 1850 it was bought by Max I., King of Bavaria, who gave to it its present name, and built the modern Casino on the ruins of an old ecclesiastical establishment. Several antiquities of various ages were discovered in excavating for the foundations: these remains are still preserved there.

The tradition in the neighbourhood is that a heathen temple once stood on the island, which afterwards became a Christian church, and was much resorted to by pilgrims when there were no other churches in the neighbouring villages; that the dead were carried there for burial, and that the island was joined to the mainland by two bridges; but that both the church and the bridges were destroyed by the Swedes. This myth M. Schab considers as almost entirely groundless; but he says that it is certain that the island was used as a general place of burial for the neighbourhood down to a late period of the middle ages. In fact, both prehistoric and Roman remains were found in several of the graves. These, however, do not come within the scope of the present notice; but it is very certain that the island was connected with the mainland by two bridges, only one of which, however, appears to belong to the prehistoric age.

The first excavations for pile-dwellings were made in the years 1864 and 1865—probably those referred to in the notice given in the first edition of this work. A regular relic-bed was found full of bones and wrought specimens of stone, horn, and wood.

In July 1865, a small regular platform was discovered about 3 feet 9 inches below the water level covered with mud: it was raised up, and a careful drawing was made of it. See Plate CLXXXIII. It was composed entirely of round timber; the stems had been cut by a number of small strokes as if by stone or bronze celts; the stems varied in diameter from 6 to 12 inches: the cross beams, which were rather even in thickness, were 17 or 18 feet long, and were fastened to the frame by wooden pins. The frame itself was about 25 feet long. A quantity of round wood was found very near the frame, and evidently had been part of the platform, which doubtless rested on the piles and formed the ground floor of the settlement.

In March 1874, fresh excavations were undertaken, as the water was uncommonly low. Seventy-six pits were sunk, in most of which a relic-bed was found, varying in thickness from 40 to 47 inches. Several localities—which were under water, but which were near groups of piles—were also examined by the mud-machine or scraper. In some cases no relic-bed at all was found; probably the ground here was newly made. In one, three platforms were found like the one just described. In two pits there were two relic-beds, or rather the relic-bed was divided into two by a bed of sand. The relic-bed was a black peaty mass, loose and greasy to the touch, often mixed with sand and gravel. Altogether about 28 cwt. of bones were obtained, and about 4 cwt. of pottery; 554 implements were found, of which 187 were of stag's horn, 158 of bronze, 69 of stone, 48 of bone, 7 of wood, 6 of iron, 3 of glass, and 1 of amber. A number of hazelnuts of a broad shape, burnt corn (like barley), and many other seeds also occurred in this bed. The bones of the domesticated animals were twice as numerous as those of wild beasts. The following is a list of the latter:—

Sus scrofa ferus, of large size, probably from . . .	14 individuals
Sus scrofa palustris, probably from	76 „
Cervus alces. Only a few portions of horns.	
Cervus elaphus	75 „
Cervus capreolus	5 „
Cervus tarandus. One single long cylindrical portion of the horn, flat in the lower part, may be considered to belong to the reindeer.	
Antilope rupicapra	1 individual
Ovis aries	24 individuals
Capra hircus	9 „
Capra ibex. No bones, only one damaged horn-core.	
Bos taurus, at least	133 „
„ brachyceros. One skull very like it.	
Bos primigenius. Several bones.	
Lepus variabilis	1 individual
Castor fiber	4 individuals
Ursus arctos	5 „
Canis lupus. One fragment of a jaw.	
Canis vulpes. Two nearly perfect skulls and a tibia.	
Felis catus. Lower jaw of large size.	
Canis familiaris. But few remains are left of the peat dog.	
Canis matris optimæ, Leitt.	9 individuals

A number (*verhältnissmässig häufig*) of human remains were also found, chiefly on the west side of the island. These have been examined by Professor Kollman, '*Ueber frühere und jetzige Bewohner Bayerns, Braunschweig,* 1874,' and also by Professor Virchow; but there seems to be some little doubt on M. von Schab's mind whether they really belonged to the relic-bed or not. It may perhaps be well to mention some of the difficulties which beset the antiquary who wishes to separate the different ages by a well-marked line. It is, as M. von Schab says, quite possible that, during the formation of the relic-bed, rubbish might be thrown from the island, which it is known contained numerous graves of the primitive inhabitants. Then, again, the relic-bed contains objects of all sorts and of all ages—stone, stag's horn, bone, bronze, iron, amber, pottery, wood, and glass; and they all lie intermixed, the heavier objects appearing to have sunk down so that the stone and bronze implements, even an *iron* horse-shoe and a great iron knife, Plate CLXXVIII. fig. 12, were found almost immediately on the original lake-bottom, while the lighter stone and horn implements were found higher up in the relic-bed. Thus some caution must necessarily be observed in attributing any objects found to the generally received ages, unless other facts join to attest the period.

The objects selected from M. von Schab's paper are drawn on the Plates before mentioned, and will now be very briefly described.

Stone.—The flint objects appear to have come from the district of the Alps: they do not correspond with the French flint implements; they are chiefly of a blue-grey colour.

Two specimens were found of nephrite—one of them is drawn Plate CLXXXII., fig. 4. Professor Fischer, of Freiburg, has examined them, and states that they agree with the nephrite found at Meilen.

Fig 6 is a common stone celt.

Figs. 1, 2, and 3 are arrow or lance heads of flint. A large number of flint chips were found, a fact which seems to indicate that the flint implements were manufactured on the spot. A number of grinding stones of different varieties of hornblende slate occurred here; and also four of the lower mealing stones for crushing corn, &c., in good preservation.

Ten polishing stones consisted of 'flysch-marlstone': two of them are drawn, Figs. 7 and 8.

Nine stone celts were found: five of them perfect.

Implements of Stag's Horn, Bone, and Teeth.—A large proportion of the specimens drawn on Plate CLXXXII. belong to this class, as, for instance—

Haftings or handles. Figs. 5, 19, 21[1], 39, and 43.

Arrow or lance heads. Figs. 11, 12, 13, 17, 33.

Horn hammers. Figs. 14, 15, 16, 23, and 41.

Tools of bone and teeth. Figs. 18, 20, 24, 26, 30, 31, 32, 34, 35, 37, 38, and 42.

Shuttles (?). Figs. 22, 25, and 28.

Horn knife. Fig. 27.

Awl or pointer. Fig 29.

Bone skate. Fig. 36.

Ornaments of boars' tusks. Figs. 40 and 44.

Bone dagger. Fig. 45.

Ornaments of wild boar's teeth. Figs. 9 and 10.

Of the bronze objects several are drawn. Plates CLXXVIII., CLXXIX., and CLXXXI.

Plate CLXXVIII. Fig. 1 is an ornamented bronze plate;

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[1] Fig. 21 on the Plate is unfortunately made like 27.—[Tr.]

Fig. 9 is part of a bronze armilla; Fig. 13 is a knife with the handle and blade all in one; Fig. 14 is a bronze dagger.

Plate CLXXIX. Figs. 1, 3, 4, 6, 7,[1] 9, 10, 11, 12, and Plate CLXXXI. Figs. 1, 2, and 3, are pins of various forms and ornamentations; some of them have very elegant patterns worked on them.

Plate CLXXXI. Fig. 3 has an eye or opening near the point, probably for more secure attachment to the hair.

Plate CLXXIX. Figs. 2 and 5 are needles. Fig. 2 is of a peculiar form, and it may have been a hairpin. Most of the pins are round and smooth; some are ornamented with various lines—circular, straight, parallel, and zigzag, in various combinations. The ornamentation frequently extends down the pin itself. Some of the patterns evidently have been formed when the pin was cast; but others have certainly been scratched in or engraved afterwards. Fig 8 is a bronze pointer or awl.

Plate CLXXXI. Figs. 4 and 5 are knives; the blades are ornamented. Fig. 6 is a bronze arrow-head with a socket. Fig. 7 is a double fish-hook without barbs. Fig. 8 is an anchor-shaped mass of bronze; use unknown.

Several of the bronze implements have been analysed; they vary a good deal, but the following may be considered the general proportions:—

Copper	from 90	to 94½	parts
Tin	„ 5	to 8	„
Iron	„ 0¼	to 0¾	„
Nickel	„ 0⅛	to 1½	„

Objects of Clay.—These consisted of spindle-whorls of various sizes and forms—some of them were pear-shaped: of counters with a hole through the middle (possibly ornaments), Plate CLXXVIII., figs. 2 and 3; portions of clay rings, or supports for cups; short cones somewhat quadrilateral, possibly net weights, Figs. 6 and 7; and beads of burnt clay of an orange colour, with concentric ornamentation of white and blue circles, Figs. 5 and 8.

The pottery, as before mentioned, was very abundant; but not a single perfect vessel was obtained. The pieces must have belonged to hundreds of vessels, and evidently are merely rejected fragments. The ornamentation is very varied; a few of the more remarkable patterns are given on Plate CLXXX. Many of the vessels were made of clay, mixed with quartz grains and small stones. All sorts of varieties of material are found, such as 1, rough clay; 2, grey pottery; 3, black pottery; 4, roughly worked clay; 5, clay mixed with quartz, sand, &c.; 6, fine black clay mixed with graphite.

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[1] Fig. 7 is of a peculiar form. It is about 10 inches long and bent round at the top; the upper end is pressed flat. It may possibly have been intended for writing. Some shorter pins, chisel-shaped at one end and pointed at the other, are considered by M. von Schab as 'styli,' 'römische schreibegriffel,' an idea which to me appears very doubtful.—[TR.]

Objects of Wood.—Wooden wedges, wooden spoons, and a fragment of basketwork.

Iron Objects.—An iron knife is drawn, Plate CLXXVIII., fig. 12, the blade and the handle plate all in one; the latter has been fastened to the horn or wooden handle by five bronze rivets. This would seem to date from the time before the Romans got possession of the Cisalpine province (see Lindenschmit, band ii. heft. vi. taf. 4). An iron horse-shoe with six nail-holes, widened on one side so as to receive the heads of the nails; opposite to each hole the shoe is widened: this is probably of comparatively recent date, for in the Roman times the horses' feet were protected by shoes of iron, made of iron plate, turned up and fastened to the feet by thongs.[1] The heads of javelins, Figs. 10 and 11.

On the whole these iron specimens are few and comparatively insignificant.

Glass, &c.—A small glass bead, and a larger one with zigzag lines, Plate CLXXVIII., fig. 4; also an amber bead.

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[1] As the feet of the oxen used for agriculture are protected at the present day in the Eifel.

In the Trèves museum there are some good specimens of these 'plate shoes.' There is also a shoe similar to that mentioned in the text: it was labelled 'Allemannic' in the Trèves catalogue, and is very like one found in the Wurm See.—[Tr.]

LAKE DWELLINGS IN THE MOND SEE (AUSTRIA).

BY DR. M. MUCH.[1]

THE investigations of the settlements in this lake began in the month of March, 1872, for at this period of the year the water is the clearest, and many implements of stone, bone, and pottery could be picked up from the surface of the lake-bottom, although the water was 12 or 13 feet deep.

This lake dwelling is found in front of the outlet of the lake, between the little inn called the 'Lake' and the forester's house at Burgau. It is somewhat difficult to give the exact size, as so much of it is covered with sand, but as far as it can be ascertained it is probably from 90 to 110 yards long and from 33 to 43 yards broad, so that it may cover an area of more than 3,500 square yards. It does not, however, take any regular figure, but the outline varies according to the depth of the water. The piles also do not seem to be very definitely arranged; they are sometimes very close together, and at other times are wide apart. They are from 3½ to 8 inches in diameter, and are perfectly soft, except that part which was driven into the bottom, which is in good preservation.

The whole of the objects of stone and the pottery found here were covered with a thick coat of mud and lake marl. Stone hammers, celts, and mealing stones were obtained in tolerable abundance. Numerous slabs were found amongst the piles. Some of them were polishing stones, and came chiefly from the mountains north of the lake. Some of them may have been hearth stones.

The earthenware vessels will be found more fully described hereafter. The clay from which they were made was mixed with calcareous sand, so that they cannot have been burnt in a strong fire. Though made by the hand alone the forms of these earthenware vessels are good.

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[1] This account is taken from three reports on the lake dwellings of the Mond See, by Dr. M. Much, published in the 'Mittheilungen der Anthropologischen Gesellschaft in Wien.' The first two, which were printed in the second and fourth volumes of this Society's Transactions, are comparatively short; but Dr. Much's third report in this fifth volume gives very full information; and it will be seen that a considerable portion of it is reprinted here nearly entire.

Amongst the earthenware vessels some of the most curious are the melting pots, one of which is drawn Plate CLXXXIX. fig. 3, one-third of the full size. The clay in this case is not mixed with sand, and there is a kind of projection with a hole in it, probably for the insertion of a handle. The whole of these vessels must have been exposed to a considerable heat, for the clay is almost vitrified. As a portion of one of them was found with some minute grains of copper or bronze in the cracks, covered with patina, there can be no doubt about their being actual crucibles or melting pots, and therefore the inhabitants of this settlement, at any rate towards the close of its existence, must have been acquainted with bronze as a metal, and also with the mode of working it.

In his second report (Mittheilungen, &c., vol. iv. p. 293), Dr. Much gives the result of his examination of this lake in the year 1874. As formerly, he began his work in the spring, when the water is clear, and he obtained many specimens similar to those which had been previously obtained.

Some portion of this report is occupied with endeavours to show that the lake dwellings were placed with an especial view of being free from the great pressure of the broken ice in the spring, and Dr. Much also believes that such parts of the lake were chosen as would be especially favourable to the fisherman. By following up these ideas he seems to have discovered the lake dwelling of Scharfling on the southern bank—the second settlement found in the Mond See.

This settlement does not appear to have been a very large one, so far as it can be ascertained from the extent of the piles. Pottery as well as implements of bone and stone were found here.

As the Lake of Fuschl is so near the Mond See, it may be included in this notice; and it is somewhat singular that here are found decided proofs of a 'fascine' lake dwelling, in many respects similar to several found in Switzerland. This little lake and its banks are rich in fish and game. On the west side of the hill, where the former archiepiscopal hunting lodge stood, there is a small bay with an island evidently made by human hands. It is nearly circular, about 50 paces in diameter, and is separated from the mainland by a narrow ditch or canal now nearly filled up with moss and marsh plants. The island is covered first with a thick layer of peat moss and heather, beneath which lies a mass of branches chiefly of the mountain pine and the dwarf birch. The island is very little raised above the water, and must have been very liable to be overflowed. The foundation appears to consist of boughs of pine trees with their branches turned inwards. Small piles are driven in to keep them together, and on the side of the lake a number of stronger piles, or the remains of them, may be seen, amongst which lies a quantity of woody débris. Such are the particulars of this singular structure, but it is difficult to decide its age, as we had not the means of using the mud machine, so as to judge by the specimens found. The wood seems less decayed than that of the dwellings in the neighbouring lake, but this may have arisen from the peaty water. A further examination of this place is highly desirable.

The following is the substance of Dr. Much's third and last examination:—

'Last summer I continued the excavations in the lake dwellings of the Mond See. In that near Scharfling my attempts were fruitless, for the greater part of it is covered by the rubbish brought down by the Kienbach, which is close by, and which is so solid that the scraper of the mud machine could not be made to enter it. The difficulty was increased by the depth of the water, which was nearly 10 feet.

'I was more fortunate at the settlement near the outlet of the lake, and here, as formerly, we obtained a rich harvest of stone celts and hammers, flint implements, pottery, and implements of bone and horn, ornaments, and a variety of things such as would probably be found amongst the household furniture of a poor lake-dwelling village.

'Amongst the most interesting discoveries were what are called the half-moon-shaped flint knives (Krummesser). They describe the segment of a circle, one side being curved and the other straight, or nearly so, Plate CLXXXVIII. fig. 1, which is drawn two-thirds of the natural size; it is about 6 inches long, and the greatest breadth is rather more than 1½ inches. It is made of opaque flint, with as much skill as the Danish implements of this kind. Two others quite as good were found in the lake dwelling at Puschacker in the Atter See. They are now in the collection of Madame Kobek, in Vienna. Two flint implements were also found in the excavations set on foot by the Anthropological Society of Vienna, in the Atter See, and were described by Count Wurmbrand in the Transactions of this society. They appear to me to be two portions of these half-moon-shaped flint knives.

'These knives are of a type which is peculiar to the north, especially to Denmark, and as far as I know they have never before been found either in our own district, or further south, or in Italy; in fact, their presence here marks the southern limit of this northern type.

'But still they cannot be considered as imported implements, for they are made of the very same kind of stone which was used for nearly seven hundred other specimens found in the relic-bed. Besides which the numerous flint chips made when these implements were being worked, prove that they were manufactured on the spot, and not imported. Some of the arrow-heads were found in the process of manufacture, Plate CLXXXVIII. fig. 5. One arrow-head was made of crystalline quartz, but was not finished, as from its tendency to split it was found unfit for the work, and was therefore thrown away.

'The half-moon-shaped flint knives found in the Upper Anstrian lake dwellings were undoubtedly native productions, and their occurrence both on the shores of our Alpine lakes, and on the coasts of the North Sea, indicates a connection between the races inhabiting the two districts.'

Two flint knives of another kind, Plate CLXXXVIII. figs. 2 and 3, are peculiar, having projections for handles: they somewhat resemble the knives used by our modern leather-cutters. The sketches are drawn two-thirds of the full size.

'Several scrapers were found. These were probably used for working in wood.

'The lance-heads of flint were sometimes very perfect, such as that drawn Plate CLXXXVIII. fig. 4; occasionally they were found quite unsymmetrical, like Fig. 5. I lately found in the Mond See a lance-head with the point bent upwards. As this could not have been thrown with any certainty, the weapon of which it formed a part was probably used for thrusting. Many of the arrow-heads are very well made; one instance may be seen in fig. 12 and another in fig. 8, Plate CLXXXVIII.

'The flint for all these would readily be found in the gravel of the neighbouring stream, which brings down a rich variety of material.

'The skill of our Upper Austrian settlers is well exhibited in the bored and polished stone hammers, two of which are drawn Plate CLXXXVIII. figs. 9 and 10, about two-thirds of the full size. Fig. 10 was found last summer: it is of spotted serpentine, and is equal in workmanship to those found in Denmark. It appears as if greater care in the execution was used where the stone was remarkable for its colour and quality.

'As a proof that these were native productions a specimen may be brought forward which is drawn Plate CLXXXVIII. fig. 6. In this case the side of the perforated part broke off, and probably in consequence of this the implement was turned into a celt. It is worthy of remark that within the perforation numerous faint striæ may be noticed, the effect probably of having been bored with sand.

'Of all the implements found in the lake dwellings stone celts were the most numerous; sixty-nine perfect specimens and fourteen fragments were secured; most of them were of native stone, but some were made of stone evidently brought from a distance. In general these celts were symmetrical in shape, but sometimes the cutting edge was sloping or diagonal, as for instance that drawn Plate CLXXXVIII. fig. 11. This is often the case with the Danish celts. The longest celt was about 6¾ inches long, the shortest about 2 inches; the breadth varied from 2¾ inches to 1¼ inch.

'Amongst the bone and horn implements, the bone chisels, as they are called (probably used by the potters), were very frequent, as also were the pointers. Some of them have a little furrow round them so that they might be fastened with a string. Both in the Mond See and the Atter See, double or forked bone pointers are found, and are not very uncommon. They are made out of the long bone of a ruminant, and in many cases one of the points is broken off, but a perfect specimen is drawn Plate CLXXXVIII. fig. 7, two-thirds of the full size. The Swiss consider similar implements as having been used for combing or heckling flax, but those found in the Mond See seem too slight for this purpose. One of them has a furrow round the thicker end as if for a cord or string, which looks as if it had been carried about the person. This does not seem quite to agree with the idea of a flax comb.

'It is singular that though eighty-three stone celts were found, only one single stag's horn hafting was discovered, and this was not as usual made to hold the celt, and then to fit into a wooden club; but it was hollowed out at one end for the celt, and bored in the middle at right angles to receive a handle. Other implements of stag's horn, like hammers, were found also perforated for a handle, and sharpened to a point at one end; these may have been used as weapons. Similar implements were found in the lake dwelling of Laibach Moor. One arrowhead of bone was found of a triangular form, and very carefully worked.

'Although no bronze implements were discovered, yet it seems evident that the settlers knew of this metal, for lately portions of crucibles or melting pots have been found with small grains of copper and slag still adhering to the sides. Also in the Atter See there were some small ornaments of bronze, and here in the Mond See four wooden handles were found which undoubtedly are of great interest, as they bear on the above question: two of them are in good condition; they are branches bent nearly at a right angle, one end of the branch evidently formed the handle, while the other or shorter portion was cleft in the middle for some little distance from the end; and also fashioned into a rod-like form with a shoulder above the termination of the cleft portion. It is evident that this handle was especially adapted for the use of the paalstab, the central plate of which would fit into the cleft, while the side wings or flaps would wrap round the part so split and hold it fast. The work on these wooden handles is so neat that it can hardly have been done with stone tools, and the space in the cloven part is much too small to admit a stone celt. From all these evidences it seems that the settlers had some slight knowledge of bronze, but the rare occurrence of the melting pots seem to indicate that this lake dwelling existed quite early in the transition period.

'From the examination of the Atter See by Count Wurmbrand, and of the Mond See by myself, the number of specimens jointly obtained were 180 of horn and bone, 500 of stone, and 700 of bone and stone, with some dubious traces of work upon them, while there were only 10 bronze implements and certain indications of the metal, two doubtful specimens of iron, and also as above mentioned 10 or 12 melting pots, so that the preponderance of stone-age objects over those of a metallic age was very great.

'When we take into account that bronze would be an expensive article, especially to poor fishermen, and that if any bronze object fell into the water, every effort would be made to recover it, we may consider that the district or perhaps rather the fishermen in the Mond See settlement, belonged to the stone age, though perhaps not to the period to which that term may be most strictly applied.

'There is hardly any evidence as to the manufacture of linen cloth to be derived from the remains found in the Mond See. But it is possible that these poor fishermen may have known of the art of weaving though they did not make use of it, especially when we remember how little of the adjoining land was fit for growing either corn or flax. Still it is in any case a singular fact that in the lakes of Upper Austria no spindle-whorls whatever have been found; but this fact is certainly no positive proof that weaving was unknown, for at the present day the Slovaks on the March river still use wooden spindle-whorls instead of those of clay, or fix a lump of moist unburnt clay round the spindle, which answers the same purpose as the regularly burnt spindle-whorl.

'Of what are called the loom weights of clay, and which in my opinion are rather doubtful, only one specimen was found. Nothing of the kind was discovered either in the Atter See or the Traun See.

'Some specimens of cord or string, now and then knotted,[1] and a closely platted mat were brought up from the relic-bed with a great deal of difficulty; they were not made of flax, but of bast.

'With respect to the pottery, as in our former excavations, fragments of large vessels were brought up in great numbers, but only in small pieces. Occasionally the greater part of a capital vessel was secured, and sometimes whole and perfect jars, which from their small size had escaped destruction by the mud machine.

'All of them without exception were made by the hand alone. It cannot be a matter of wonder that the potter's wheel was not used here, as it was totally unknown during the whole of the Hallstatt period, which was much later. It was not till the days of the Roman rule that the potter's wheel came into use on the shores of our Austrian lakes.

'The larger vessels are made of coarse bad clay, mixed with a considerable quantity of sand from limestone, and in consequence could only have been imperfectly burnt. The surface is only partially smoothed, or in some cases quite rough. The larger vessels are for the most part coarse and clumsy, and never have handles, but a few have knobs or projections under the rim, or on the bulge, so as to admit of a cord or string being passed through them. They are chiefly unornamented, see Plate CLXXXIV., on which are sketched the outlines of several of the vessels found here; where any ornament does occur on these large vessels it consists merely of a line of impressions of the finger running round the vessel, or of notches or hollows in the rim or edge, which in general is perpendicular, though sometimes slightly bending outwards. The dimensions of these large vessels (in spite of the stoutness of their sides, which are not much less than half an inch thick) are not considerable, none of them are more than 16 inches high; but this may be readily accounted for by the inferior quality of the material and the slight baking which they have undergone.

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[1] Perhaps part of a fishing net?—[Tr.]

'Some of the smaller vessels are more than an inch both in height and breadth. These little vessels are made with still less care than the larger ones: they are often nothing but a lump of clay pressed round the finger. Some few have the shape of a saucer or small cup; sometimes they have a handle or a knob for a cord to pass through, or are ornamented in the most simple manner by a line running under the border. These miniature vessels are so carelessly and clumsily made that one is led to imagine that they may have been nothing but children's toys. Similar miniature vessels were found in the lake dwelling of Laibach Moor, and in the prehistoric settlements of Lower Austria.

'Amongst the most interesting relics of the lake dwellings of the Mond See, and of Upper Austria generally, are the clumsy but richly ornamented jugs or earthenware vessels which have been found there. They are made of finer clay, and are smoothed outside. In colour they are now greyish black, but from some few fragments found here it would seem probable that, owing to some organic admixture, they were originally of a deep black colour. For the most part they are provided with a handle, either large or small. The ornamentation is very characteristic, and consists of a number of well-defined lines, from $\frac{1}{25}$ to $\frac{1}{12}$ of an inch wide, hollowed out of the clay while yet moist; and in most cases the bottom of these lines was punctured with a pointer, or some similar tool, so as to hold more firmly the white material with which the lines were filled. Notwithstanding the coarseness of these vessels the white lines on a black ground must have had a capital effect. See Plates CLXXXV. and CLXXXVI.

'As the makers of these vessels were acquainted with bronze it will not be surprising to find that some of these patterns recall to mind those which came into Europe together with bronze, as for instance, Plate CLXXXV. figs. 2 and 5, and Plate CLXXXVI. figs. 4 and 7. These are drawn half-size. Sometimes there is a zigzag line running round the whole vessel, Plate CLXXXV. fig. 5. In other cases a double row of alternating points or dots runs round and forms a kind of meandering pattern, Plate CLXXXV. fig. 2. On other vessels two lines twine together, each of which is ornamented on both sides with dots, Plate CLXXXV. fig. 4. Other patterns are given, figs. 3, 6, and 7, and also Plate CLXXXVI. figs. 1, 2, 3, 5, and 6. The vessels drawn Plate CLXXXIX. figs. 1 and 2, are richly ornamented.

'The pottery of the lake dwellings of Upper Austria, more especially in its ornamentation, does not yield to that of any other place— and yet there is a certain likeness between it and that found at Laibach Moor. The clay, with an admixture of limestone and sand, and the mode of burning appear to be the same, so that some specimens can hardly be distinguished one from the other, while those from the graves of Hallstatt, the lake dwellings of the Wurm See, &c., can be told in a moment. But with respect to the ornamentation the case is different. At Laibach Moor, the cross is the most common design, and the circle and zigzag lines are used in a manner totally distinct, though the lines forming the pattern are in both places impressed and filled with a white matter. Even in Lower Austria pottery is found ornamented with the same white lines, which, however, were not impressed while the clay was moist, but scratched in after the vessels had been burnt, and afterwards filled in with white substance. Though the Mond See ornamentation is very striking, yet that of Laibach Moor appears lighter and more delicate. Both are very characteristic.

'Amongst the productions of the potter we must mention the melting pots before referred to. No spindle-whorls, discs, or rings were found here, as in many other lake dwellings. The figures of animals found here are of great interest. I was fortunate enough to obtain six: they are rudely made of light-coloured clay, but still, in spite of the extremities being generally broken off, the kind of animal they are intended to represent can easily be made out. Plate CLXXXVII. fig. 1 appears to have been meant for a cow or a pig; fig. 3, for a dog. There may be a doubt as to fig. 2, but it evidently was intended for an animal with horns, so that we must choose between a chamois, a goat, and a cow. Beneath each figure outlines are given which represent the probable appearance which these rude representations would have had when perfect. They probably were children's toys.

'It is singular that at a comparatively short distance from the Mond See, namely, in the graves of Hallstatt, similar rude figures of animals were discovered, but in this case they were of bronze. (See von Sacken, 'Grabfeld von Hallstatt' taf. xviii. figs. 31, 32, and 33.)

'The personal ornaments found in the Mond See are very interesting. Perforated teeth were found in such numbers near each other that they must have been used to form a necklace. The claws of birds and beasts of prey were also used as ornaments, and some claws were imitated in white alabaster, at least this appears to have been the case, with what probably was intended for the claw of a falcon. Perforated plates or beads of stone were sometimes found in abundance. At one haul of the mud machine, 48 were brought up; they are from $\frac{1}{8}$ to about $\frac{4}{10}$ of an inch high, and from $\frac{3}{10}$ to $\frac{4}{10}$ of an inch broad. Even the backbones of fishes were perforated and used apparently for ornaments.

'The following table gives a summary of the specimens found:—

Implements and Ornaments	Stone		Horn and Bone		Wood		Totals
	Perfect	Imperfect	Perfect	Imperfect	Perfect	Imperfect	
Celts	62	19	—	—	—	—	81
Wedges	—	—	—	—	4	—	4
Hammers	5	5	1	—	—	—	11
Haftings for celts . . .	—	—	1	—	—	—	1
Handles for bronze celts .	—	—	—	—	—	4	4
Lance and arrow heads. .	25	—	1	—	—	1	27
Unfinished arrow heads .	5	1	—	—	—	—	6
Flint knives	17	—	—	—	—	—	17
Scrapers	27	—	—	—	—	—	27
Half-moon knives. . .	1	1	—	—	—	—	2
Pointers	—	—	34	—	5	—	39
Double pointers . . .	—	—	3	8	—	—	11
Perforated teeth . . .	—	—	16	—	—	—	16
Beads	113	—	—	—	—	—	113
Bone chisels and sundry other objects . . .	114	1	38	16	1	16	186
	369	27	94	24	10	21	545

Besides which there were 8 specimens of bast, 30 earthenware vessels, 100 specimens of ornamented pottery, 6 figures of animals, 8 crucibles and portions of them, 1 clay weight, about 600 flint chips, and a quantity of refuse of common pottery, bones, and the remains of beasts.'

THE LAKE DWELLING IN LAIBACH MOOR, AUSTRIA.

By Ed. Freih. von Sacken.[1]

The discovery of late years of so many pile dwellings in a variety of districts, has led antiquaries to believe that they existed near the shore in all the larger lake basins of our country.

The discovery of a lake dwelling in Laibach Moor, in July 1875, is one proof of this.

This great peat moor covers an area of about 85 square English miles. It is intersected by the rivers Laibach and Isca,[2] with a number of smaller brooks. In old times it was doubtless an inland lake, but this cannot be definitely proved from history.

The peat moor, like most of the lake-bottoms of Upper Austria, consists of sandy loam mixed with numerous remains of fresh-water shells, which give it a whitish colour; the shells belong to species common to most of the fresh-water lakes of Middle Europe. The sediments of sand and clay, evidently formed slowly, and the absence of gravel from the surrounding mountains, show that these deposits took place gradually. The bed of loam is some yards thick, and lies upon the 'Tegel' or clay. It seems that the lake has several times been partially dried up, and then again overflowed, as besides the beds of sand and loam there are in many places beds of peat varying in thickness. This is confirmed by the former existence of a gravelled road leading from the valley of the Isca in a north-easterly direction to Laibach, from Brunndorf to Babna Gorica, portions of which were found at a depth of 10 feet, to the east of Brunndorf. The road had been made upon a bed of peat, and afterwards the peat had grown over it.

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[1] The above notice is somewhat abridged from the account published by the author, but only those portions have been omitted which seem to refer to the general subject rather than to this individual settlement.—[Tr.]

[2] Having resided more than half of my life on the banks of the river Isca or Usk, in Monmouthshire (at one time the heart of the Celtic district of England), it was with no common interest that I read of a lake dwelling on the other side of Europe, on the banks of a river of the same name, evidently of Celtic origin—Uisc = water or river.—[Tr.]

When the level of the water sank gradually the peat began to form slowly, as may be seen in many peat lakes of the present day. It can hardly be determined how long the area, occupied by the later peat, existed as a lake. This does not appear to have been the case at the time of the Roman emperors, for then the Laibach of Nauportus (Upper Laibach) was on a navigable river,[1] but being so small a place it was abandoned as the emporium for Italian wares and Roman munitions of war, and Æmona, or Laibach, took its place.[2] The above-mentioned place is without any doubt of Roman origin.

The drainage of the moor was undertaken about 45 years ago,[3] and it thus lost in a measure the character of a high moor. It was then about 1,300 acres in extent, and at that time the streams were navigable, so that formerly ships had sailed where now luxuriant meadows are to be seen; and the peat moor has been converted into rich agricultural land.

In the year 1857, when the peat was being dug in the neighbourhood of Moosthal, not far from the former tile-works of the Southern Railway, under a bed of peat about 10 feet thick, and lying upon the clay, three hammers were found, made of stag's horn, from 6 to 6¾ inches long, perforated with oval holes, placed lengthwise in the horn; the brow antlers were cut off. These implements had been blunted by use; only one is sharpened at one end.[4] At that time these specimens excited wonder, but since then they have been explained by numerous other specimens having been found. In the same locality two boats (Einbäume) were discovered in the peat, they probably may be connected in some way or other with the stag's horn hammers. Several other tools and implements were brought to light when the peat was dug out, but unfortunately they were dispersed before any drawing could be made of them.

At the southern edge of the moor a little north of Brunndorf, about 550 yards from the ancient shore, which is seen here very distinctly in the form of a bank, numerous piles were found in July of last year, when excavating near the new road leading from Laibach to Brunndorf; they had been driven into the sandy loam of the subsoil, and reached up into the bed of peat, lying above it, which is here from 5 to 6 feet thick. Between the two there was a layer of mud, or rather of decayed plants, 4 or 5 inches thick, in which were found the remains of wood, charcoal, vegetable matter, together with the bones of animals, pottery, and worked pieces of stag's horn—evidently what is called the relic-bed, as in the lakes of Switzerland and Upper Austria. Fortunately this discovery was made by the right man, and in the right place. The owner of the ground, Martin Peruzzi, who with great good judgment knew the meaning of the discovery, at once communicated it to the museum at Laibach, on which the custodian, Dr. Carl Deschmann, continued the excavation systematically, and the inhabitants of Laibach took great interest in it. The strennous labours of both the gentlemen, which were crowned with success, deserve our especial thanks. Under Dr. Deschmann's careful superintendence the excavation was continued till the 7th of October, and an area of about 110 yards by 28 yards was uncovered.

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[1] Plinius, H. N. iii. 18; Strabo iv. 207; compare vii. 314.

[2] Mannert, 'Ancient Geography,' iii. 730. Nauportus, which was destroyed by the barbarians under Augustus (Tacitus, 'Ann.' i. 20), does not appear again either in Ptolemy or the 'Itineraries.'

[3] See Fr. Count Hohenwarth, 'Contributions to the Natural History and Topography of the Duchy of Krain.'

[4] These implements are now in the museum at Laibach.

Quite a forest of piles might be seen here irregularly driven into the sandy mud of the subsoil, and as many as three or four in a dozen square feet. They ran nearly parallel with the southern bank from east to west, the average breadth being about 82 feet. The whole number of piles was about 3,500. They consist chiefly of trunks of the aspen, poplar, and elm, and but very rarely of fir, or what is called 'needle-wood.' They had been brought to a blunt point below, but had not been sharpened by fire; they only reached up to the bed of peat, or at most, a little way into it; most of them were so decayed that they could be cut through with the spade, and fell to pieces when dried in the air. In some places piles of a later date were driven in with the others, but they are much more decomposed. Mr. Peruzzi very carefully made a great plan of the whole settlement, marking in exactly every individual pile; amongst these piles in the bed before mentioned as lying between the clay and the peat, and consisting of decaying organic matters, were found the remains of the former settlement. There were implements and animals' bones in extraordinary abundance, stones brought from a distance, remains of wood and charcoal (the latter small in proportion), and a very large quantity of hazelnuts, and other seeds.

One peculiarity of the station is, that the implements of horn and bone are much more numerous than those of stone. Most of the implements of horn were made out of the antlers of the red stag, more especially those tools which would answer both for hammers and axes, and which we therefore call hammer-axes, Plate CLXVIII. figs. 1, 2, 3, and 5. More than 150 of them were found in all stages of manufacture, and more or less worn; some appeared quite new, and others were too old for use. In order to make them, a piece of the antler, from 8 to 12 inches long, was separated from it in a diagonal direction, then the brow antler was cut off and the hole made for the handle,[1] probably in the first place by hammering with a narrow stone chisel, or by burning with a sharp red-hot stone point, then the hole was bored about an inch in diameter from one side, probably by means of a tine or point of an antler with sand and water. These implements were always bored perpendicularly to the longer axis, from the outer to the inner side, so that the cutting edge, made by grinding either one or both ends of the specimen, is made horizontal, not vertical—that is, its direction is parallel to the handle, so that the tool was somewhat clumsy and unhandy; certainly not very much could have been done with it, and evidently the cutting edge soon got blunted and had often to be renewed, so that many of these hatchets, especially those sharpened at both ends, Fig. 2, became quite short, Fig. 5. The blunt end with the rose piece, sometimes with a pretty large portion of the bony base, was in many cases used as a hammer, or else it became useful as a counterpoise, Fig. 2. Others were sharpened at one end, and at the other were ground down to a broad convex surface. Some of them had the remains of the handle still remaining in them. In the specimen drawn, Fig. 1, the boring has been begun, but was never completed.

The pointers and spatula-like implements, found in such numbers, were made from the bones of stags and other animals, and the larger implements, like daggers, Fig. 4, were formed out of a whole long bone with the joint still remaining, which served for a handle; they are from 4 to 10 inches long, and many of them are perforated so as to be carried by a string, Fig. 12. The smaller pointers and awls were made out of split bones, often mere splinters, arranged so as gradually to run to a point, and sometimes made very sharp, Figs. 6 and 7. Many of them are very carefully wrought, in fact, polished so that nothing is seen of the hollow of the bone; in others the workmanship was less precise, and the workman was satisfied with pointing an irregular splinter; several of them have an artificial furrow made lengthwise, or an incision round the upper and broader end. The pins, drawn Figs. 9 and 10, are very neatly worked; they are in a measure like Roman styli, at one end broad and diagonally flattened and sharpened at the other; they are from 1½ to 4 inches long. The sewing needles are often very slender, the eye is either round or rather long, Fig. 11.

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[1] In one specimen the boring is completed, but the brow antler is only cut round and not completely separated.

These implements probably were put to various uses, as, for instance, in the preparation of clothes, and the making of pottery; for the latter purpose a variety of rounded flat spatula-like instruments were also used. They occur elsewhere, both in graves and in most of the stone-age lake dwellings, and are frequently found with bronze implements; some very similar ones occur in the lakes of Upper Austria.

Some few bone implements are rather more doubtful, and as far as I know have not been found before. They are as follows:—

1. Pieces of antlers cut off diagonally, regularly sharpened, perfectly polished, and with a well-bored hole in the middle. Four specimens were found from 3½ to 4 inches in length. The holes were bored in different positions, Figs. 14 and 20. Some people have thought them to be the tops of gaffs, or fish spears, but from their excellent workmanship they probably are ornaments.

2. Polished marrow-bones, 5 or 6 inches long, with the condyle removed, and open at both ends, Fig. 19. There are marks on the edges as if string or thread had been drawn through them, and at last, by a repetition of the process, furrows had been formed; they have also other marks, which indicate that fine thread had been passed round them. This implement reminds one of the Slovenian spindle.

3. Tines of antlers ground down on two sides at the broader end, and only on the concave side towards the point, perforated with rather a long hole, Fig. 15; or with a deep incision on one side near the top, and the part remaining above perforated lengthwise, Fig. 16. Possibly these implements may have been used for making coarse nets. Five specimens were found, varying in length from 5 to 8 inches. They all differed in form one from the other; on some of them may be seen the furrows worn by threads.

4. Clothes' hooks of rather a neat shape, Figs. 13 and 17; they are well made and polished; they have from 2 to 4 perforations at the broad flat end, so that they may be sewn to some material; at the other end there is a short barb. One specimen has a well-formed head. They were unquestionably used for keeping together the garments over the breast or on the shoulders.

5. An ornament, 2½ inches long, made out of the tine of an antler, cut off at both ends. It is perforated lengthwise, and has two broad bands, one at each end, made of diagonal lines crossing each other, and thus forming a chequer-work, Fig. 8.

6. The lower jaws of small oxen, without the teeth, and so much rounded and smoothed that they must have been used for a long time in rubbing some roughish but soft substance. Probably they were implements for preparing leather.

Cutting implements, corresponding with our shoemakers' knives, were made of split and partially polished boars' tusks, the hard enamel forming a capital cutting edge. Similar specimens were found in the Swiss and Upper Austrian lake dwellings.

The polishing hones, from 3 to 6 inches long, on which all these implements were ground or sharpened, were also found with them. They consist of fine sandstone; many of them have on the surface sharply-defined narrow furrows, and one is perforated at the end.

The implements of stone found here are few compared with the numerous implements of horn and bone. The stone celts, elsewhere so abundant, are represented here by a single specimen about 2½ inches long, of very hard green hornstone, very little wrought—in fact, merely a pebble ground down. Only four stone hammers were found, one of which is perfect; three of them are of dark serpentine, and one of limestone. As usual, the boring had been begun on both sides, so that the hole is rather narrower in the middle. Only five specimens of flint were found, and it evidently had been brought from Bilichgraz, about 12 English miles to the north-east. These specimens consisted of lance-heads from 3½ to 5 inches long, and flat flint knives with double edges and pointed at both ends; they were all chipped like those found in Denmark. The flint flakes which have been struck off from them show that these implements were made on the spot, and the same thing seems indicated by the apparently unfinished borings begun on some small stones, which probably were used for one end of a two-pointed implement in boring holes. But the settlers must have had very many stone tools, judging from the large number of polishing or grinding stones found from 12 inches in length upwards; they consist of hard quartz conglomerate, and the hollow grinding surfaces give undoubted proofs of having been very much used. Hand polishing-stones were also found, and one 'touchstone,' with a perforation begun on both sides, but not corresponding.

Amongst the most important things discovered, and probably such as may decide the age of the station, are some bronze objects, all found in one place, beneath the bed of peat, and under precisely the same circumstances as the rest of the specimens. They are five in number.

1. A short sword, with a flat reed-like blade about 10½ inches long and 1¼ inch in its greatest breadth. It is ornamented with double raised lines on the blade. The plate or tongue of the handle had been provided with plates of wood or horn, fastened with five rivets, placed in a semicircular form, at the beginning of the blade. It is one of the small-handed swords which are found so commonly on both sides of the Alps.

2. A hairpin, 6¼ inches long, Pl. CLXVIII. Fig. 18, the head of which is a pyramidal knob. It was of cast metal ground to a point below.

3. A long broken pin with the point ground down on two sides. The part which remains is nearly 8 inches long.

4. A knife or dagger about 3¾ inches long, of cast metal, quite flat. The tongue of the handle had been made by hammering together part of the broad metal plate.

5. A small flat object, 1½ inch in diameter, actually a piece of thin cast metal plate.

The two latter specimens, the alloy of which is richer in copper than the others, appear to have been the productions of a native foundry. But all of them exhibit the regular bronze colour without patina, like those commonly found in the lake-mud, and more especially under peat. With them were found fragments of peculiarly fine earthenware vessels. Possibly this was the habitation of the president or head of the tribe.

Our lake-dwellers especially excelled in the art of pottery, although made by the hand alone, without the aid of the wheel, which probably was unknown at that time in this district. The earthenware vessels exhibit such a variety of form, and the sides, which are thin, are formed with so much regularity as quite to surprise us. In general these vessels are such as are commonly used for household purposes. They may be seen by hundreds in the Laibach Museum, quite perfect, together with an immense quantity of fragments. The larger urn-shaped vessels, very much bulged, with a small base and a short neck to pour from, have no proper handle, but they have two horn-like perforated appendages at the upper part of the bulge, through which cords might be passed; the largest is nearly 9 inches high, and the diameter of the bulge is the same; one which is 5½ inches high has four of these perforated appendages on its border.

The vessels with one handle are more or less bulged, generally slightly so, more rarely with the bulge entirely at the bottom, or with quite straight sides; several have on the bottom five or six flattish stud-like processes, probably intended to prevent the contents of the pot from burning when placed upon the hot stones.

Numerous cups are found, both deepand shallow; the greater part are without handles, but the deeper ones have a kind of horn-like projection, or have two of the above-named processes; they likewise have a bulge; only quite the smaller ones, like a modern tumbler, have straight sides. Some of the cups with feet, and ornamented both inside and out, look remarkably neat. These feet have four notches cut in the material, and thus each foot is somewhat in the shape of a cross, and it has also within it the figure of a cross impressed on the clay, Plate CLXVII. fig. 8. Some little jugs without handles are only 1½ inch high, and from their size seem only to have been children's toys.

These earthenware vessels were all carefully made; the base was first shaped by the hand alone, and when the sides were added afterwards they would be very likely to become irregular, which in fact was the case with many of the vessels found. The colour of all of them is blackish, arising from the nature of the clay; several, however, had been blackened, and, in fact, we found a cylindrical mass, about an inch long, of the colour used for that purpose, which consists of ground charcoal mixed with an earth like umber. To avoid breaking it to pieces, and perhaps also for more easy manipulation, it had been coated with a covering of clay; one end shows that it had been used, as it bears traces of rubbing.

Several vessels were found perforated like sieves; they are said to have been used for making cheese. Similar vessels have been found in the lake dwellings of Switzerland and in Lower Austria. Some specimens of earthenware, which still retain traces of the action of a strong fire, may have been the supports of the pipkins; they are 5 or 6 inches in diameter, and there are holes round the edge. One of them has a border an inch high fixed upon it, very probably intended, like the before-mentioned projections on the base, to prevent the contents of the pipkin from being burnt by leaving a space between it and the fire. An earthenware spoon with a handle is just of the same shape as our modern wooden spoons. Some few specimens were found, the use of which we cannot decide, such as little cylinders about 3 inches long, without any base except a flat border all round, and a long oblong specimen about 4¾ inches in length, hollowed out like a tray, both above and below, like a little tile mould.

Great skill is exhibited in the variety and, in some cases, the elegance of the vessels, but the ornamentation is still more remarkable. It consists of lines and dots engraved with some sharp instrument, and combined in so many different forms as to raise our ideas of the fancy and taste of the lake-dwellers. Sometimes there are bands made of rows of stripes edged with dots or points, Plate CLXVII. figs. 1 and 2, then wheel or lozenge-shaped figures; sometimes rectangles or circles, within which is described either a straight or diagonal cross, Figs. 3, 4, and 6, or zigzags and chequerwork, Figs. 5 and 12, in several variations. Amongst 30 vessels which were found either whole or in fragments, there were not two alike or even similar. The pointed bands, the crosses, and the rhomboid or triangular figures engraved upon these vessels, Figs. 4, 6, 9, and 11, may be considered as particularly characteristic. The use of the cylindrical vessel, Fig. 7, is unknown. One cup of an elegant form, with a foot, is ornamented on the inside with rhombs and points placed in a cross; and on the outside with zigzag lines. It may safely be affirmed that as yet no other lake dwelling has yielded vessels of earthenware so well made and so delicately ornamented, together with implements of stone and bone, or showing such a developed taste, as these specimens from the lake dwelling of Laibach.[1]

Several specimens of earthenware, perforated, and in the shape of balls, pears, or cones, Plate CLXVII. fig. 10, from 1½

[1] The ornamented pottery from Sesto Calende is somewhat similar, and also a cup from Yverdon ornamented on the inside. Some specimens of pottery from the tumuli at Hildesheim, and from a stone monument near Osnabrück are rather like ours. Lindenschmit Alth., &c. I. 3 Heft. Taf. 4.

to 2¾ inches long, well burnt, and sometimes ornamented with a circle of little impressions around them; may have been net-weights, or possibly have been used for spindle-whorls. Smaller earthenware beads may have been ornaments, like the pe teeth of bears, pigs, and badgers, and also the incisors of young cattle, a number of which have been found.

Wooden cups were made by hollowing out the great knobs or irregular growths upon the oak stems; two of them were found together with a wooden cooking spoon.

A very large quantity of bones were found with these implements, altogether many hundredweight. The greater part were long bones, nearly all split lengthwise to get at the marrow, which is a proof that they belonged to animals used for food. Very few indeed were whole. Large pieces of the skull were rare, so that it is difficult to determine the races.

The majority were those of the stag (*Cervus elaphus*), which must have been abundant in the surrounding forests, as the bones amount to about 35 per cent. of the whole. Some flattish fragments of antlers indicate a stag with shovel-shaped horns, perhaps the elk or moose deer (*Cervus alces*). It remains to be decided whether any of the bones belong to the giant stag (*Cervus megaceros*) or not.

Next to the stag, amongst the beasts of the chase, those of the wild boar are the most numerous, and very splendid teeth have been found; also a very large and perfect skull of a wild sow. The remains of a smaller size probably belonged to the marsh pig. Some giant bones are probably those of *Bos primigenius*, which does not appear to have been rare. Both bones and teeth of the bear occur, the latter often perforated to serve as ornaments, and this was the case also with the teeth of the badger. The roebuck is more rare, and the wolf probably still more so. The remains of the beaver are especially interesting with reference to the local fauna. Fragments of the skull and lower jaws in good preservation, many of them of large size, have been found. Up to the present time there is no historical notice of the existence of this animal in Carniola. The bones and teeth of a small rodent belong probably to the dormouse (*Myoxus avellanarius*). Some hazelnuts, which have been gnawed, seem also to indicate the existence of this animal.

Amongst the domestic animals may be mentioned the cow, and also the sheep and goat, which are still more abundant. The species of the first-mentioned animal living at that time has yet to be determined. Some parts of the relic-bed appear to consist of the droppings of domesticated animals very much decayed (mixed with the leaves of the willow and oak, with their characteristic nervures). This manure shows that these animals were kept by the settlers. The jaws of the pig agree with those of the present domestic race, and occasionally the bones of very young animals occur.

The remains of the dog were found—that faithful follower of man in all ages and in all places. No bones of the horse have yet been discovered here.

The following is the percentage of the bones found:—

Stag	35 per cent.
Goat, Sheep, each	15 „
Pig	13 „
Ox	8 „
Beaver	6 „
Bear, Badger, each	3 „
Roebuck, Dog, each	1 „

But few birds' bones were found, but those of fishes were very numerous, some of very large dimensions. Many vertebræ are from 1½ to 1¾ inch in diameter. There are pike's jaws 5½ inches in length, with teeth ¾ of an inch long. The fisheries in these ancient times must have been very productive, and very fine sheat-fish (*Silurus glanis*), pike, and carp seem to have been taken.

Besides animal food, both of wild and domesticated animals, the lake-settlers appear to have made use of some kinds of vegetables. Enormous quantities of hazelnuts are found here, as is usual in most lake dwellings, together with the cornel-cherry, raspberries, the white thorn, and the water-chestnut (*Trapa natans*). The kernel of the latter seems to have been made into meal. The use of this plant as food is mentioned by *Pliny*, *H. N.* xxii. 10, 12,[1] 'Thraces qui ad Strymona habitant foliis tribuli equos saginant, ipsi nucleo vivunt, panem facientes prædulcem, et qui contrabit ventrem.' On this subject Mr. Deschmann remarks: 'At the present day the water-chestnut is not found in Krain (*Carniola*), and ever since the earliest botanical examination of the country by Scopoli, it has never been considered a native plant in the *Flora Carniolica*. In the last century the monks of the Cistercian order at Sittich cultivated it in their ponds.' The Swedish botanist Areshong, in his treatise on the waternut, has given it as his opinion that the water-chestnut was brought by the hand of man from the Caucasus and spread over Europe; it may not be impossible that it was brought from Thrace to Carniola by the lake-dwellers.

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[1] Pliny mentions two kinds of tribulus—that growing on dry land (*terrestris*), and that in rivers or lakes. The latter is probably the waternut found in Austria in March, and also in Carinthia. Compare Plin xxi., 1658.

In spite of careful search no corn has yet been found in the relic-bed of Laibach Moor; and as very delicate plants and leaves are well preserved in it, one would have imagined that some of the ears and husks of corn would certainly have been found there if the lake-settlers had been possessed of them. The mealing-stones found so commonly seem to have been used for grinding the water-chestnuts. They are great stones, with hollows like trays, corresponding with the round handstones, or rubbers, of porphyry or quartz conglomerate, in shape like flattened balls, from 3 to 4 inches in diameter, and often ground down or worn on one side.

The cords and linen cloth so common in the Swiss lake dwellings are entirely wanting here. With the exception of a little bit of bast thread wound together, and a little stone wrapped up in bast, nothing of the kind has been found. So that it seems doubtful whether the lake-settlers were in any way agriculturists.

The great fungus (*Polyporus fomentarius*),[1] very singularly, is not of rare occurrence. On some specimens may be seen the marks of the axe by which they were cut from the trees, to which they often adhere firmly. They can hardly have been used for any other purpose than that to which they are put at the present day in the mountains, namely, to make tables, vessels, or other articles of furniture. A large number of stones of all sizes were used by the settlers for different purposes. Many of them had been brought from a distance. Traces of fire are seen on several, and these were evidently hearthstones. Together with them were pieces of clay, like the flooring, burnt through. Pieces of limestone were found, perforated by 'boring shells,' and somewhat resembling small filtering-stones.

No human remains were found, except a lower jaw about 3¾ inches broad, with one tooth remaining in it. There is nothing particular in it, except that the ascending ramus is more upright than usual.

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[1] Several fungi of the genus *Polyporus*, when fresh cut from the tree and properly cooked, form an excellent nitrogenous food. *P. fomentarius* has long been valued as yielding the best *Amadou*, or 'German tinder,' of commerce, though inferior kinds are made from other species. It may have been used even at this early period in procuring fire. Iron pyrites and flint with tinder made from fungi, were, no doubt, constantly used, long before flint and steel 'strike-a-light.'

The distance of the settlement from the shore—nearly 550 yards—is far greater than in other lake dwellings; it would consequently appear that at that time the lake had become smaller than it had been at a still earlier period.

In general character this lake dwelling agrees with the numerous stations in East Switzerland, the Lake of Constance, the Atter See, and the Mond See, but in all those the stone implements are much more plentiful. It agrees perhaps better with the settlement in the Lake of Starnberg, in Bavaria, where the bone implements preponderate.

It is difficult to determine the age as in other lake dwellings. At all events it lasted a long time, and the few bronze implements show that it came down to a period when bronze swords and pins came into our country by means of the great Etruscan trade, at the time of the Roman Republic. The settlement of Laibach was not, like many of those in Switzerland, destroyed by fire, for in that case we should have had heaps of charcoal and half-burnt wood as well as the coverings of the huts hardened by fire, and other burnt objects, which is not the case. It is much more probable that it was destroyed by floods, or what is more likely still, that it was voluntarily abandoned by the inhabitants, who took with them all their most valuable tools, especially those of stone.

THE LAKE DWELLINGS IN THE ATTER SEE (UPPER AUSTRIA).

By Count Gundaker von Wurmbrand.[1]

I. *Seewalchen.*—This settlement is situated just where the Ager runs out of the Atter See. It is sheltered from the north wind by a little rise of the land behind; and as far as can be ascertained, it was in the shape of a rectangle. Possibly the place where a stream flows out of a lake was preferred to that where it flows into it, as in the latter case the water might be muddy, and not so favourable for fishing. This consideration seems to have decided the situation of several Swiss lake dwellings.

The settlement of Seewalchen appears to have been above 450 or 500 English feet long and about 160 or 180 feet broad. The western end is 200 feet, and the eastern end 300 feet, distant from the shore. The bottom of the lake is neither muddy nor sandy, but covered with gravel, and the water becomes gradually deeper towards the south. At the end of the settlement the depth of water is about 5 feet.

Although the water is uncommonly clear, neither piles nor any implements are to be seen on the bottom. It was not until the gravel had been removed by the mud machine, that the piles became discernible. They seem to be about 3 or 4 feet apart, and some of them have decayed to a cork-like substance so as to be easily cut by the scraper, while others are quite hard. Probably the first are of firwood. The others I could not draw out; they may be of oak. Apparently they are driven into the lake mud, and are not surrounded by a heap of great stones, which M. Desor considers as the characteristic mark of the more ancient lake dwellings. The piles are of round wood, 6 or 8 inches in diameter. The relic-bed, which now appears, is a blackish conglomerate of organic remains, so much pressed down by the superincumbent gravel, that it forms a matted mass not easy to be separated. It is probably about a foot thick, and it rests upon the lake marl. The specimens seem very generally scattered through it, and are brought up with it.

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[1] This account is condensed from two papers given by the author in the 'Mittheilungen der Anthropologischen Gesellschaft in Wien.'—[Tr.]

Possibly the metal objects form an exception: they are easily distinguished, and can be brought up by the pincers. A great quantity of pottery, implements of stone and bone ornaments, and pieces of charcoal, and even of mineral coal, are found in the relic-bed.

On the whole I have come to the conclusion that this lake dwelling was not destroyed by fire, or any other overpowering calamity; for there were no large masses of charcoal, no burnt grain, none of the hardened hut coverings, neither were the implements found in any large quantity in one place. The specimens are scattered here and there, not broken, or unfinished, or worn out. Now all these facts seem to indicate but one period of time, and no very long occupation. Had the latter been the case we should, in my opinion, have found a much larger number of organic remains and of implements. And in the case of a succession of occupations there would have been intermediate characteristic beds.

The general type of this settlement is that of the stone age, for though there are metal objects, yet they are quite inconsiderable, and the immense quantity of pottery indicates the coarse mixture and rude forms of this period.

Some few of the antiquities shall now be referred to, and in the following order: Implements of horn, flint, &c., polished stone, ornaments, metal objects, pottery, polishing stones, animal and vegetable remains.

The horn implements are not in good preservation. It is very remarkable, as M. Desor has mentioned, what a variety there is in the state of preservation of horn implements in different lakes. Pointers, chisels, and scrapers have been found here, but singularly enough none of the stag's-horn haftings for celts, so common elsewhere, have been discovered in the Atter See. Nor any drinking cups made out of stag's horn.

Implements made of hornstone, chert, or flint, all frequently go under the name of flint tools, as flint occurs in Denmark and the North of Europe plentifully, and is well adapted for the purpose; but the specimens which I have found in the South of Germany, Switzerland, and Italy, are of hornstone, which does not answer so well as flint, and consequently these tools are not equal in workmanship to those made in the North.

One small knife was found made of obsidian, a mineral chiefly found in Iceland and Sicily, but which is occasionally found in the shape of pebbles, near Tokay. Of arrow-heads several varieties are met with, but none of them have the central stem or projection frequently found in other places. Plate CXC. fig. 8, and Plate CXCI. figs. 1, 2, 3, 4, and 5 will give some idea of the general forms; they are drawn half the natural size; fig. 8, however, differs from the usual shape.

Only one of the celts, sometimes called hammer-axes, was found perfect; it is drawn Plate CXCI. fig. 7. The other specimens were broken, like Figs. 8 and 9. These celts are usually of serpentine in every variety, but they are sometimes found of diorite, greenstone, granite, hornblende rock, &c.; no regular nephrite has yet been discovered.

The greater part of the ornaments found were beads and rings of horn, in one case of mineral coal: and here it may be well to mention that several fragments of pit coal were found in the settlement, probably brought here to be made into ornaments.[1] Amongst other ornaments, a curious one is drawn Plate CXCI. fig. 6. But little can be said about it, except what is shown in the sketch—it is of sandstone, like a pebble, perforated in two places, apparently it has formed the centre of a necklace.

If the metal objects found here may not be considered chance intruders of a later date, they are at all events small and insignificant: still they ought to be mentioned. Plate CXC. fig. 11 is a small and well-made bronze pin; the head is round, lengthened above pyramidally, a third part of the pin is round with incised rings, it is perforated in the middle, the lower two thirds are quadrilateral and ornamented with dots; the needle is rather more than 1¾ inch long; it is somewhat like those found at Peschiera. A second small pin was found subsequently. Fig. 10 is a bronze awl, sharpened at both ends. The most singular things, however, of metal are those drawn Figs. 9 and 12, which are of *iron*. At first I considered them as chance introductions, and had nearly thrown them aside as the productions of the Middle Ages, but the form of Fig. 12 reminded me of the ornaments on the Celtic bronze armour as seen at Hallstatt, and the reader must form his opinion from the sketch given; they probably were ornaments, and apparently are of pre-Roman date. If these metal objects are contemporaneous with the lake dwellings, they show that the settlers had already begun to have intercourse with races further advanced in civilisation. One specimen ought to be mentioned under this head, but of course the doubt expressed as to the other specimens applies also to this, for it is an irregular roundish lump of bronze, which might lead us to suppose that the casting, or possibly the re-casting, of bronze implements was not totally unknown to the inhabitants. The evidence is small, but it would not have been right to have omitted it.

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[1] The ornaments found in England, made of Cannel coal, probably belong to a later period.

As a general rule the characters of pottery are very distinctive in deciding the age of a settlement: here, however, it is not so. Specimens are found apparently of all grades of civilisation. There are many varieties, from vessels made of very coarse clay mixed with grains of stone, made by hand, to such as are manufactured of well washed clay, and apparently turned on the wheel. No earthenware vessel was brought up whole by the mud machine. But judging from the fragments, we may arrive at the following conclusions. Apparently all the vessels are coloured either with graphite or some other colouring matter, and they have all been burnt in an open fire. The ornaments are simply rough impressions; a late excavation has brought to light some pieces of pottery with more ornamentation, such as that drawn Plate CXCI. fig. 21, and also other pieces, having the impressions either of the finger nail, or of a bone implement, such as figs. 17, 18, 19, and 20. Handles are rare, and yet a series of specimens might be picked out showing the advance of the potter in his art: first the knob, then the perforated knob to allow of the introduction of a cord, then the knob with the perforation enlarged, so as to admit one or two fingers, and lastly, the handle completely formed, wide enough to admit the three fingers of the hand together.

The polishing stones, of which a large number were found, show that the settlers in this station were well acquainted with the mode of working stone with sandstone.

The animal remains belonged to the pig, the bear, the beaver, the ox, and the stag.

The vegetable remains were those of the fir, the lime, the beech, the oak, the birch, the hazel, and the cornel-cherry.

Amongst the bones of animals, there were some which were partially burnt; and it seems from this, we may assume that the settlers roasted their meat.

II. *Aufham.*—This settlement has been but little examined, the water is deep, and it is small in extent. There appears to be a kind of steinberg here, as the piles are placed near to each other, and around them lie a number of large angular stones, forming a little hill or rise on the lake-bottom. A few flakes of hornstone, some coarse pottery, and a small celt of serpentine, seem to indicate that this station belongs to the stone age.

III. *Weyeregg*, is noted for its beautiful bone implements. It is about 2,500 square yards, English, in extent, and it was worked through the whole summer: a rich harvest of bones was the result. The bone pointers were very well made. Amongst them were some with double points, but only one was perfect, it is drawn Plate CXCI. fig. 13; the others had one of the prongs broken off as in Fig. 12. A little ring of stag's horn was found on one of the points or prongs of one of these specimens, so that it seems probable that they were used for some industrial purpose. Various other tools were made out of different bones; but the chisels of bone are not quite so common here as in other lake dwellings—out of 100 actual bone tools, there were only 18 bone chisels. The tines, or ends of horns, were frequently encircled with a furrow, as, for instance, Plate CXCI. fig. 15. But when the furrow had by chance been cut too deep, so as to come into the central spongy part, and thus made the tool or the 'hold' useless, it was apparently broken off and thrown away, Plate CXCI. fig. 14.

Numbers of bones were found here which are interesting, as they are all split: apparently this was done to obtain the marrow. Professor Steenstrup, at Bologna, showed that all the bones which were found split had not been broken for the sake of the marrow: but that only those which had what may be called a hole of percussion, or a small place broken into when the blow was given, could with certainty be affirmed to have been split by human hands; the bones found in this settlement all have this peculiarity. Plate CXCI. figs. 10 and 11 are bone fragments sharpened. Hornstone[1] implements are scarce, but a very good lance-head was found, drawn Plate CXC. fig. 13; polished stone weapons are more plentiful. One celt found here is translucent, hard, and of a sea-green colour, but still it is not nearly as hard as nephrite. Can it be of jadeite?

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[1] This word is literally translated, the original is 'hornstein.' But may it not have been intended for 'chert,' which, in fact, is in English frequently applied to hornstone, or to 'any impure flinty rock.' See Bristow's 'Glossary of Mineralogy,' p. 76. Chert is said to occur in the uppermost beds of the upper greensand of the South of England, in the Purbeck and Portland formations, and in the Carboniferous limestone beds.—[Tr.]

Amongst the ornaments there is a great bear's tooth, perforated at the commencement of the enamel, Plate CXCI. fig. 16.

The pottery varies very much in material: sometimes it is blackish, with coarse grains, and sometimes brownish, with fine grains; it varies also, as at Seewalchen, both in form and ornamentation. See Plate CXC. figs. 2, 3, 4, 5, and 7.

A large number of polishing stones were found here, and also a piece of pit coal like that from Seewalchen: it is not the Traun Valley coal, but from some locality much farther off; from the circles marked upon it, it had evidently been brought here to be made into ornaments.

IV. *Puschacher.*—This small station is between Steinbach and Weyeregg. Hornstone chips are plentiful, but no hornstone weapons. There was a very peculiar round stone ball of polished serpentine found here, which had a well-formed hole in the middle for a handle. It must have been too costly for a net-sinker, or for any object of daily use. It is drawn Palte CXC. fig. 6; we may probably consider it as a weapon, or a mace. No metal objects, nor any ornaments were found here, but a large earthenware vessel, drawn Plate CXC. fig. 1. It is 5½ inches high, and about 4 inches broad. It has three small knobs on the bulge, and it is ornamented on the upper part with irregular, and apparently half-finished, points or dots. It was made by the hand alone, and although very carefully manufactured, the outline is irregular.

V. *Atter See.*—This settlement is near Aufham, and close to the place which bears the same name, and the landing-place of the steamer.

Very little work was done here, and yet the results were sufficient to enable us to consider it as a regular lake-dwelling. A very good hornstone lance-head was found here; the work is excellent; several hornstone chips, also two pieces of serpentine celts, and a quantity of pottery.[1]

VI. *Kammer.*—This settlement was erroneously said to be rich in antiquities, but it is in fact only a portion of Seewalchen.

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[1] From all the stations in the Atter See there were obtained about 3 cwt. of pottery without ornamentation; the pieces which are ornamented are comparatively rare.

THE LAKE DWELLING OF THE NEUSIEDLER SEE, IN HUNGARY.

BY COUNT VON WURMBRAND.

WE are indebted to Count von Wurmbrand for a brief notice of this settlement; it is given in the fourth volume of the Vienna 'Mittheilungen der Anthropologischen Gesellschaft,' p. 291. And although no piles were actually found, yet from his account of the place there can hardly be a doubt as to its having been a regular pile-dwelling.

Count von Wurmbrand was invited by Count Bela Szechenyi to see the discoveries he had made on his estate of Zinkendorf, lying on the banks of the Neusiedler See. On the southern shore the lake has retreated, and the reclaimed land is now being gradually brought under cultivation. (This lake, we are informed in Murray's Handbook of Southern Germany (1858), is 'a sheet of *salt* water more than 60 miles in circumference, overgrown with weeds, and ending towards the SE. in the morass called Hanság, larger than the lake itself. At times it overflows its banks 1,000 feet; at others it sinks below its ordinary level. Its greatest depth in the centre varies from 9 to 13 feet, but it is so shallow near its margin that only the smallest boats can navigate it. Considerable quantities of salt crystallise on its shores in summer, when the lake shrinks; and its water is found on analysis to contain glauber as well as common salt, yet fish, such as carp, pike, &c., live in it.') In one place on the reclaimed land, for a distance of about 500 paces, an immense number of pieces of pottery, bones of animals, and broken stone celts are found scattered over the surface. In some places the ground is blackish; but the specimens are chiefly found on the surface; where the ground is ploughed up a quantity of organic matter is brought to light, but very few implements.

The pottery, although in many cases turned on the wheel, was of very rough manufacture, and frequently had the customary marks, or ornaments, impressed by the finger-nail, or the round holes made by bone pins. Only a few of the smaller vessels had been formed by the hand alone, these were the only ones preserved entire; the clay from which they were made had been mixed with quartzose sand. There were the usual handles perforated for suspension by a cord. These facts, and also some peculiarities in the edges or borders, strongly reminded me of the pottery of the stone age.

Flint implements were rare, but still a few were found which may be called knives. About 30 specimens of celts of serpentine were obtained, most of them perfect; they are from 1½ to 5 inches in length. Stone hammers are rarer, only one perfect specimen was found; all the others were broken either lengthwise or across. The bone implements, from exposure to the air, were in bad condition; some of the smaller ones were so much decayed that nearly all traces of workmanship had disappeared.

Although these specimens were scattered over so large an area, yet one can hardly resist the conviction that, in former days when the lake extended further than at present, there must have been a lake dwelling here. The fact of no piles being visible may probably be accounted for by their rapid decay, from alternate exposure to air and water. If any portions of piles still remain they would be found deeply buried in the earth; but no examination on this point has yet been made. It is to be hoped that further investigations will decide the matter, for it would be of great interest to ascertain positively the existence of a pile dwelling in this lake, and to prove how wide-spread this mode of settlement was in the olden time.

MECKLENBERG AND POMERANIA.

In the year 1863 the remains of a lake dwelling were discovered at Gägelow, near Wismar, and subsequently Dr. Lisch ascertained the existence of a regular lake dwelling in the peat moor of the town of Wismar, which goes by the name of Lattmoor.

This low ground, which is partly dug for peat and partly used as a meadow, formed undoubtedly in early times a regular large freshwater lake: the surface was then considerably lower, and some portions of land appeared above the water as islands, and were covered with wood. The lake where the piles are found was about 10 feet deep, and it is at present quite filled with black mould, the remains of leaves and decayed waterplants. In this mould the piles are to be seen 10 feet long and about 2 feet apart; they have been driven 2 feet into the ground. The remains of five huts were also to be noticed, some of them rectangular, and some of a round form. Upon the black mould which fills the ancient lake basin, there is at present a bed of alluvial earth 1 foot thick, but the heads of the piles do not reach up to it. Above this bed there is a stratum of peat 5 feet thick.

The antiquities, which were found in considerable numbers amongst the piles, are in general very similar to those of the Swiss lake dwellings. We may, however, remark that amongst the stone implements flint takes the place occupied in Switzerland by serpentine, diorite, &c., and that the pottery is of a peculiar character.

This lake dwelling evidently belongs to the later stone age.

From the account of Dr. F. von Hagenow, it appears that he has also discovered a lake dwelling at Greifswald, in Western Pomerania.

(See the 'Jahrbücher des Vereins von Mecklenberg,' by Dr. Lisch, 1865.)[1]

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[1] It is perhaps right to say that in some of the German periodicals a doubt has been lately expressed as to this Wismar settlement having been an actual pile dwelling. I cannot see why; our information is taken from Dr. Lisch's published report, and this is clear and decisive.—[Tr.]

Supplement to Mecklenberg and Pomerania.

About the same time that Dr. Lisch made the above discoveries in Mecklenberg, similar antiquities were found in Pomerania, and have been described by Mr. Kühne, in a paper read before the Pomeranian Historical Society, on the 16th December, 1876. This paper was published on the 21st and 23rd of that year, in the 'Neue Stettiner Zeitung,' from which the following account is an extract:—

After giving an epitome of the most interesting facts relating to the Swiss lake dwellings, he goes on to say that 'the first trace of these erections in Pomerania came to light when the river Ryk was deepened at its mouth near Wyk. Unfortunately no scientific investigation was made of them at the time. Mr. Von Hagenow, who is one of the most energetic investigators of our antiquities, hastened to the place as soon as possible, and secured a few mealing stones, hammers of stone and bone, and also a copper poniard, but most of the specimens had been dispersed, more especially the bones of animals, which would have been of great importance, but which had all gone to the bone mill. Notwithstanding this it seemed tolerably certain that this settlement had the same character as those in Switzerland.

Another lake dwelling essentially different was found in the year 1863, in the Persanzig lake, at Neustettin, and was most carefully and scientifically investigated, and described by Major Kasiski (Balt. Stud. xxiii. i. p. 77). Round a little island in the lake are the remains of piles of about sixty small huts, 10 or 12 feet square, made of horizontal round wood, some of them laid in forked piles. The settlement was joined to a little islet on the north by a bridge, and this islet was also joined by a second bridge to the mainland. A row of palisades ran round the settlement on the side towards the land. Much care and skill had been bestowed on the structure, more especially on the bridge. On the island were found stone pavements made level with clay, handmills, and mealing stones, clay net-sinkers, an iron wedge-shaped hammer, a skate made of bone, and a great deal of pottery. The ornamentation of the latter comprised a variety of patterns; there were forty-three modifications of the type which belonged to the age of the Vends, and was found chiefly at Burgwällen, so that it has been called the Burgwäll type. From these particulars we may conclude that this erection was a lake fortress, used by the Vends as a place of refuge: probably, however, only in time of war.

Another small settlement probably discovered about the same time in the Hegar Lake, near Sabin, in the district of Dramburg, is again of a different kind. This timber erection had essentially the character of a small wooden abode, which might have been occupied by a man of knightly condition. Almost all the antiquities found were of iron, and consisted of more than a hundred arrow heads, also lance heads, spurs, bits, and cutlasses. All these objects, of which unfortunately no drawings have been published, as also the form of the building itself, seem to indicate that it was of later age than the erection of Persanzig.

The pile dwellings of Lübtow, at the northern end of the lake of Plöne, are probably still more recent. When the lake was lowered in the year 1859, the lake-bottom, which was partly peaty and partly sandy, was soon covered with grass, but there was an area of about 3 or 4 English acres, where strong piles were seen, which one can easily imagine may have supported regular quadrangular buildings. Late in the summer of the present year three sides of a regular strong quadrangular wooden building were found 3 feet under the former lake bottom, resting on solid hewn double piles, from which it appears evident that the level of the lake at that time must have been at least 4 feet lower than in 1859, for these remains were completely buried in the alluvial lake-bottom. The difficult question, however, why this wooden erection lies so much lower than the heads of the other piles which still project from the lake-bottom laid dry in 1859, remains yet to be answered. That they both belong to the same age is irrefragably proved by the antiquities found in both places. They consist almost entirely of iron weapons: swords, arrow heads, stirrup irons, spurs, lance heads, and knives abounded amongst the piles; while a helmet, greaves, knives, arrow and spear heads, and spurs were found in the wooden building. In both places a large number of the hollow tiles were found which are known by the name of 'monks.' They belong to the thirteenth if not the fourteenth century. The spurs with rowels and the greaves indicate the same date, if not later.

May we not then conclude that the inhabitants were obliged by some sudden cause to quit their abodes, leaving many valuable effects behind them?—it may have been by fire, or by the fate of war: but in the latter case human remains would probably have been found, and hence we are almost justified in the supposition that a sudden waterflood obliged the inhabitants to flee, only affording them time to save their greatest valuables, their own lives, and their silver and gold, for no trace of either of these metals or of any coin has yet been found.

Lastly, it may be mentioned that amongst the piles were found a number of chisels and hammers of the stone period, and also one bronze celt; but these tools must be considered as chance specimens, possibly as part of the collection of the above-mentioned man of knightly standing who lived here, and who had no opportunity of carrying them away.

Besides the places above mentioned there are other localities in Pomerania where pile dwellings have been observed, as, for instance, on the lake of Luptow, near Cöslin, at Wollin and at Forcadenberg, but no scientific accounts of these settlements have yet been published. The lake dwelling of Wyk, near Greifswald, appears to be the only one like those of Switzerland.

THE LAKE DWELLINGS OF THE LAKE OF PALADRU, NEAR VOIRON (ISÈRE.)[1]

By Ernest Chantre.

Numerous piles had been known to exist under water in the lake of Paladru, near Voiron, and for ages past had excited the curiosity of those who lived on its banks, as well as that of the historians of Dauphinée; but instead of studying the facts in a rational manner, they chose to attribute to them a marvellous origin, and thus arose a legend which is not infrequent on the shores of several lakes, and which has lasted till our own days.

It was commonly reported that at the bottom of the lake the ruins of a very ancient city were yet to be seen, which had been destroyed by the divine vengeance. This legend has been repeated by all the authors who have written about the district from 1161 to 1860. Almost all, but especially those of our own age, have considered it as an inadmissible fable, and yet no one has thought of seeking for the true explanation of it.

This 'cursed' city of the lake of Paladru was, it is said, called Ars, and the inhabitants were punished for having persecuted the monks of the neighbouring Carthusian establishment of Sylve Bénite.

It was reserved for M. G. Vallier to elucidate the question; in fact he succeeded in proving, after having investigated the matter in 1864 and 1865, that the origin of the legend of the city of Ars was connected with the existence of the above-mentioned piles; and that the latter belonged to erections like those of which the remains are found so abundantly in Switzerland and Savoy.

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[1] The above account of this most singular or, as some people would call it, abnormal lake dwelling is taken from the notice published by M. Ernest Chantre, Grenoble, 1871. On account of its peculiarity it has been very little abridged, and especial care has been taken to give the author's exact ideas respecting it. The results of his investigation are so different from those obtained from other lake settlements that I must confess to a belief on first reading it of some mistake; but the well-known character of the author, and the very candid manner in which he relates his discoveries, soon dispelled these momentary doubts. Still, it must be confessed that it is a most singular settlement, and on this very account it ought to be known by all those who are studying lake settlements, and they must judge for themselves.—[Tr.]

So far back as 1860, Professor Fournet had informed archæologists in his remarkable work, 'De l'influence du mineur sur les progrès de la civilisation, d'après les données actuelles de la géologie et de l'archéologie' ('Mémoires de l'académie de Lyon, t. xi. xii.'), that the piles of the lake of Paladru must be those of lake dwellings.

In the autumn of 1866, when returning from the *Congrès Préhistorique de Neufchatel*, after which I had the good fortune to study numerous lake dwellings under the guidance of eminent scientific men, I resolved to attempt some excavations in the lake of Paladru, when the work of M. Vallier appeared.[1] Six stations or places where piles are to be seen had been reported by the oldest fisherman. M. Vallier has marked them down on a map in his book.[2]

This learned archæologist enters into a discussion on the probable form of the structures supported by the piles which are seen in such numbers in the mud of the lake, but no excavation having been undertaken with a view of ascertaining the antiquity of these remains, he could only state that they were like those of the lake of Bourget.

By the kind permission of Messrs. Tercinet, the owners of the lake, I began my work by dredging; and was much aided by the excellent set of boats belonging to these gentlemen, who very kindly placed them at my disposal. We tried some excavations at the south-west part of the largest settlement, known as Grands Roseaux, where the water was about 6½ feet deep, and under about 21 inches of white mud I succeeded in obtaining numerous bones of various animals, pottery, wooden utensils, the blade of an iron knife, and some fruit-stones.

We then tried the station called La Véronnière, the largest settlement after Grands Roseaux, and obtained similar remains from a few casts of the dredge.

These early results I communicated to M. G. de Mortillet in a letter dated 12th December, 1866, which he was kind enough to insert in his 'Matériaux pour l'histoire positive de l'homme.'[3]

The repeated encouragement which I received from M. de Mortillet, and from several of my friends, would not have allowed me to put off further excavations (which had only been stopped by the severity of the weather), but having ascertained that the level of the lake would shortly be lowered by the engineering works intended to regulate the outflow of the water, I resolved to wait for this more favourable period.[1]

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[1] La legende de la ville d'Ars sur les bords du lac de Paladru (Isère).—[Tr.]

[2] In the map given by M. Chantre, which has been copied in the present volume, Plate CXCV., there appear to be only five stations.—[Tr.]

[3] Third year, January, p. 61.

Last November I was informed by M. P. Tercinet that the water had sunk considerably in consequence of the opening of the flood-gates of Charavines, and I hastened to accept his invitation to renew the excavations.

The settlement of Grands Roseaux, near which I had begun my first excavations, was now almost entirely dry; but even the highest part of the ground was only a foot above the water level. Working by the dredge was given up; the shovel and the pickaxe had to be used instead, so that the state of affairs was much more favourable; yet the compact and tenacious nature of the peat, containing organic remains of all sorts in which the piles were imbedded, caused it to be cut with difficulty, for this recent bed is still held firmly together by the roots of the reeds and water plants, which run down to a great depth.

Some trenches which I had made in the highest and most central part of the little island yielded similar specimens to those I had found in 1866. Numerous pieces of wood joined with the piles led me to anticipate finding constructions of some importance, and induced me to go on with the trenches till they were nearly 3 feet deep. I was able then to note down the following as an average section:—

Peat and mud with roots of reeds and of water plants running through it, about 7 inches.

Peat, containing worked pieces of wood and some bones, about 17 inches.

Peat, containing bones, pottery, and other antiquities, about 12 inches.

Very fine white mud which uniformly covers the flat shores and the bottom of the lake.[2]

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[1] It was in consequence of an application made by the manufacturers of the valley of Fure, through which flow the waters of the lake, that these works were executed by authority of a decree made in 1865.

[2] The white mud which covers the bottom of the lake of Paladru and its flat shores, is found in most of the lakes, marshes, and swamps. [Elsewhere spoken of as 'lake-marl,' or 'shell-marl,' in this work.—Tr.]

Professor Lory, director of the chemical laboratory of Grenoble, has found this kind of deposit in a great number of similar localities. It is a local formation and not the product of the soil washed down from the adjacent lands. The following are the words of Professor Lory:—

'The carbonate of lime dissolved by the rain water becomes very much concen-

As a large quantity of wood was met with, the proprietors of the lake were induced to utilise it,[1] and the works in consequence became much larger; but as they were not carried on for a scientific object, trenches were only made where, by 'sounding,' there seemed a probability of finding wood.

The last traces of these habitations, which till then had been kept from entire destruction by the depth of water above them,

trated in the marshy grounds and in the lakes, and is deposited there as the aquatic plants decompose the excess of carbonic acid which made it soluble.'

The following are the analyses which Professor Lory has been kind enough to send to me:—

Specimen No. 1, from the flat shore of Grands Roseaux. When dried in the open air at the ordinary temperature the mud became entirely friable and void of coherence; it was then passed through a moderately fine sieve to separate from it the greater part of the vegetable remains. It still, however, retained a mixture of substances, chiefly microscopic vegetables. About 46 grains, calcined as gently as possible with a spirit lamp, lost about 1⅓ grains or 3 per cent., which may represent the water and the organic matters intimately mixed with the mass. The remainder, or nearly 45 grains, is almost pure carbonate of lime; the only residue it left was 2¾ grains of fine silicious sand (still somewhat blackened by the traces of organic matters imperfectly burnt). This residue, when examined by the microscope, shows many silicious skeletons of *Diatomaceæ*. The calcareous part of the natural deposit, examined in the same manner, appears to be amorphous, and to have been chemically precipitated, and this result has been probably caused by the organic beings which swarm on these flat shores.

The actual composition of the deposit therefore is

Carbonate of lime	91
Sand and silex of diatoms	6
Combustible organised matters	3
	100

Specimen No. 2, taken from the flat shore called the 'Ile de Loyasse,' near La Véronnière, on the north-west of the lake.

When dried and the organic portion burned as before, the following was the result:—

Silicious sand and silex of diatoms	16
Carbonate of lime	83
Carbonate of magnesia	very minute traces.
Phosphates	traces.
Organic and vegetable matter	quantity undetermined.

The formation of this calcareous deposit in the large basin of the lake of Paladru, is of considerable importance, and may help us to understand the geological formation of the ancient fresh-water lakes, nearly all of which are more or less silicious. It may be well, however, to remark that this is only found on shores which slope gently, laid dry by the recent lowering of the waters of the lake. Where the shore sinks rapidly nothing is seen but a fine silicious sand arising from the disintegration and denudation of the sandy and pebbly 'molasse' rock of the adjacent low hills.—(Extracted from the Annals of the Departmental Laboratory of Grenoble.)

[1] According to the traditions of the neighbourhood, the inhabitants of the banks have for ages taken up all the wood they possibly could from the bottom of the lake, and especially the fishermen, who had a great interest in making the lake free from these remains, which damaged their nets.

were now about to disappear for ever.[1] In the meantime these stations have afforded us one of the rarest examples of the mode of structure adopted by the lacustrine population.

In order to obtain as much information as possible from the works which were being carried on to procure the wood, I had the exact position noted down of all the pieces which were brought to light, as well as of those which my own researches had enabled me to discover.

The excavations made up to the present time give a general idea of the settlement of Grands Roseaux; its shape was circular and its area was about 4-10ths of an acre.

Two foot bridges on piles joined the settlement to the shore, that on the northern side was about 230 feet long, the other a little distance off to the east was about 130 feet in length; most of the piles still remain in their original position and show very clearly where these bridges were placed.

The piles are made of stems of trees from 10 to 16 feet long, and varying in diameter from 7½ to 15 inches—sometimes squared and pointed by the hatchet. The upper portions, which usually project above the present peaty soil from 12 to 20 inches, had been worn by the action of the waves and the alternate exposure to air and water. They may indicate the mean level of the water; some which do not project above the level of the peat still show traces of mortises.

Most of the piles had been driven into the white mud at the bottom of the lake. Some may have been made more firm by pebbles brought from the shore, as M. Vallier has mentioned; but, from the depth of the water, I have not been able as yet to verify the fact; it only occurred at the southern end of the settlement, where the water is about 6½ feet deep.

The distance between the piles varies greatly; many of them may be seen placed in groups of 4, so as to retain between them pieces of timber crossing each other, thus forming a kind of wall.

The large number of excavations made by the proprietors to procure wood, together with my own labours, have convinced me that most of them had been fastened together by what the joiners call halving,[2] so as to cross each other and form the framework.

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[1] These pieces of wood, all of oak, are of a beautiful black colour; and when once they have passed the drying chamber are used with great success in making parquetry and other wooden manufactures; some of these are intended for a château near Bourgoin belonging to one of the proprietors of the lake.

[2] That is, a portion of one of the timbers was cut away half through, exactly the

The posts or upright piles are very long, and from 12 to 16 inches in diameter. Sometimes they are 7 feet apart and sometimes more than 15 feet, the intermediate spaces probably representing the rooms. From the ground or bottom up to the level of the water, as many as five pieces of timber would have had to be laid horizontally to form the walls.

Amongst the piles many pieces of worked timber were found placed without any regularity, and these may probably be considered as the small beams and planks which formed the floors of the houses built on the general platform. None of the worked wood shows any traces of the use of the saw, and not a nail is to be seen. Even pegs or wooden pins do not appear to have been much employed.

Numerous tenons and mortises afford satisfactory proof that the chisel and the hatchet were exclusively used; even the boards seem to have been made with the latter implement.

All the worked timbers obtained up to the present time lead us to suppose that the houses were rectangular.

A large number of pieces, showing traces of work upon them, have been got out of the peat one at a time. Drawings were made of them before they had lost their shape by exposure to the air, in order that they might be studied when other discoveries should allow us to understand how they were fitted to each other. The general plan of the settlement as it was when actually found is given on Plate CXCIV.

Several tenons and grooves appear to indicate door posts and window frames; the existence of these is confirmed by the discovery of a series of keys and rudimentary ironwork.

Thongs were found in abundance; they probably were used instead of hinges.[1]

The objects of industry found in what may be called the kitchen-middings, or the refuse of the kitchen heaped round about the piles, are of various kinds.

Together with some iron weapons, there were several objects of domestic use of the same metal, a series of wooden utensils, and a very great quantity of pottery of various forms and ornamentation. Some of the most interesting specimens are drawn on Plates CXCII and CXCIII.

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width of another piece; and when this operation had been repeated in the second piece, the two would join together at right angles without any projection at the joining.—[Tr.]

[1] Thongs of hide for hinges, seem hardly to accord with the use of keys and ironwork.—[Tr.]

We will begin with those which are more especially necessary for daily use. An iron axe may be mentioned, Plate CXCII. fig. 8, somewhat resembling a battleaxe, but differing from it in not having the curve of the shoulder. Only one specimen has as yet been found of this implement, which must have been so essentially necessary to the builders of these settlements, who seem to have been exclusively carpenters.

Together with this implement were found an awl, a gimlet, a cramp, and a kind of iron chisel, as well as a number of knife blades, Plate CXCII. fig. 1. Amongst the objects of domestic use may be classed the keys, Fig. 3, which are of the most primitive forms, and also the horse-shoes, Figs. 4 and 9, which were very numerous, together with their nails. These indicate that the race of horses was a small one. A kind of currycomb was also found, Fig. 10, and a spur of rather a primitive form, Fig. 6.

Next to these specimens, which tell of a race of horsemen, we may naturally place the two sole weapons found here up to the present date, viz., a lance and the head of a javelin, Plate CXCII. fig. 2.

The inhabitants of Grands Roseaux were not without objects of dress or finery, although everything indicates that they belonged to a primitive civilisation, bordering on barbarism. These objects of dress or ornament consist of the half of a leaden bracelet, many fragments of blue jeweller's paste, and two counters made out of a flat bone of a ruminant. These two specimens are ornamented with small circles with dots in the centre of each. In Fig. 7 there is one central small circle surrounded by five others, the whole included in one large circle; the other, Fig. 5, has one central small circle surrounded by seven similar ones, but without any larger including circle; it is perforated transversely, probably for suspension.

Another series of utensils consists of wooden objects: there are spoons, almost exactly like those of the present day, drawn Plate CXCIII. fig. 1; a sort of pestle with a flat base, very like the beater of a churn; a kind of bobbin; several pieces of wood perforated with round holes, which may have been floats for the fishing nets, and other specimens, which are like the rings used instead of buckles for loading burdens on the backs of mules or horses.[1]

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[1] The words of the original are 'ressemblant à des glissants employés pour remplacer les boucles pour charger des fardeaux sur le dos des mulets ou des chevaux.'—As I

Besides several handles of tools, two specimens no less interesting were found with these objects: they are two combs, with the teeth made in the longer grain of the wood, Fig. 2; on one side they are fine, and on the other so far apart that they must have been intended to comb a textile material and not human hair.

The pottery, which is of a grey black colour, pretty well baked, had been made on the wheel, and the vessels vary considerably in shape. Hardly anything but very small fragments were found; and it is difficult to give an exact account of the original forms; but still I imagine that the most common shape of these vessels exists in a specimen which may be found in the ceramic collection of antiquities in the town of Lyons, and which M. Martin-Daussigny, the conservator, has kindly placed at my disposal.

A great number of these vessels were ornamented very simply, and quite unlike the pottery of any other age, Plate CXCIII. figs. 3, 4, 5, and 6. Only one vessel was found whole, Fig. 7; it is nearly round, and has rather a narrow neck; it is flattened on one side, and on the other there is a round hole; there are two handles on the upper part. Besides the pottery, some fragments of cloth have been found, several of which resemble that of the Roman period. A small portion of a Roman vase was also discovered.

The following is the fauna found in connection with these different specimens:—

Dog of a slender form (?) Fox (?)
Otter of a large size.
Ox—a large and a small species.
Stag of a large size.
Sheep and goat.
Horse of a small race.
Pig and wild boar (?)

The bones of the latter animals are by far the most common. Besides these, the remains of great aquatic birds were met with, and numerous egg shells. A great quantity of bones, which I have not yet been able to determine, will probably considerably extend this fauna, which already numbers many different species now actually living, but many of them not in our district.

found a great deal of difficulty in ascertaining the meaning of the word 'glissants' and could get no help from the best French scholars of my acquaintance, I ventured on writing direct to M. Ernest Chantre, and he has very kindly replied as follows: 'Quant à *glissants* (terme familier), c'est un synonyme de boucles ou anneaux en bois, dont se servent encore nos montagnards pour lier des paquets de foin.'—[Tr.]

The bones had almost always been broken to extract the marrow, and the skulls to get out the brain. I have met with several half-skulls of ruminants, and many whole lower jaws. The long bones have almost always been broken across at one end, and some have been broken lengthwise.

The flora is less varied than the fauna, and taken alone it would seem to indicate a period relatively less remote: it may be stated as follows:—

Two species of cherries.
Two species of plums.
Peaches.
Walnuts.
Hazel nuts.
Acorns.

And a great quantity of fragments of fruits of different kinds which have yet to be examined.

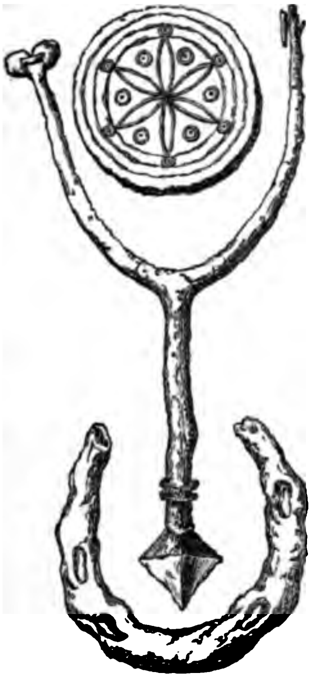
The oak is the only wood employed in the structure of the settlement at Grands Roseaux, with the sole exception of one trunk of the chestnut tree. The ash, the cornel cherry, and the box had been used for making some wooden utensils already described.

It is certainly difficult to determine the age of the settlement of Grands Roseaux; no station similar to it has yet been discovered. Specimens like those found here are rare in any collection; so that the means of comparison are almost entirely wanting. At first I thought that it might be placed on a footing with La Tène (Marin) in the lake of Neuchâtel, that is to say, that it might be classed under the first iron age; but the study of its fauna and flora, and of the objects of industry which have been found in it, led me to consider it, with M. de Mortillet, as much more recent, possibly even of Carlovingian times.

In support of this opinion, M. de Mortillet has just sent to me the sketch of an iron spur, of a pair of shears, and of a counter, which have the greatest resemblance to those which I have described; they were found in trenches made in the earthworks of the tower of Saint Austaille, canton of Cheneraille (Creuse). According to this well-known antiquary, these earthworks are Carlovingian: a coin was found there which leaves no doubt on this head. A woodcut of three of these specimens, for comparison, will be found annexed, drawn half-size; the spur and the horse-shoe seem almost identical with ours.

Besides this information, which in fact is sufficient to enable us to determine the age of these settlements, I think that I ought here to copy an unpublished note of Dr. Charvet, a distinguished archæologist, of Grenoble, which he kindly sent me, respecting the specimens which have reference to the veterinary science, a subject to which this gentleman has given special attention:—

FIG. 44.



'The spur, which was found in the waters of the lake of Paladru, goes back to the time of the barbarian invasions; it appears to me to have been made in imitation of the Saracen spurs: it is probably of Frankish origin, in the ninth century of our era. The termination consists of a cone of four facets, but the straps (*sous-pied*) instead of being made capable of enlargement or retraction, by means of an eye, like our strap buckles without tongues, has been twice riveted, so as to fit the horseman who made use of it.

'None of the spurs which have a rowel are of an age earlier than the thirteenth century.

'What confirms me still more in my opinion is, that with the spur was found at the same time a horse-shoe which belonged to an animal of small size, such as were in use at that era; and, besides this, this shoe has all the peculiar characteristics of those made when nails were first used in farriery; which occurred first in the ninth century, at the time of the lower empire. The custom was introduced into Gaul through England, by William the Conqueror, who gave to Simon St. Liz, one of his Normans, the town of Northampton and the district of Fulkley, on condition of his furnishing shoes for all his horses.

'Further, what is known in archæology as to this custom of shoeing with nails is confirmed by two ancient writings: in the "Tactics of Leo VI., Emperor of the East," book v., p. 51, and of "Constantine Porphyrogenitus," p. 11, speaking to Catecos: "Lunatos ferreos cum ipsis carphiis," &c.

'This horse-shoe (Plate CXCII. fig. 4) has three holes, called "etampeurs," on each side; it is thin, and not thickened or turned up at the heel. Round each hole there is a hollow which receives the head of the nail. The heads of these nails are finer and longer than those in use at the present day, and would be much more convenient than turned-up heels; probably they were like the ice nails used in our country in the frosty season.

'At this early period, the shoe, roughly made, was undulated on the outside by the red-hot metal bulging out when the holes were made with a square pointer. The workman had as little idea of correcting this defect as he had of making the face of the horse-shoe level to correspond with the hoof.

'Lastly, I am able to bring forward a more positive fact in favour of my opinion as to the date and origin of the horse-shoe. The Abbé Cochet in his work on the tomb of Childéric, mentions that in 1844, at Zableron, near Yvetot, some Frankish objects were found in a wooden bucket, and amongst them was a spur and an undulated horse-shoe, both exactly like those now under our consideration.

'The currycomb (Plate CXCII. fig. 10), although a most primitive affair, is complete, and is by no means inferior to those made at the present time, consisting of a number of teeth fixed on a plate called the body.

'We may readily imagine that the groom could get rid of the dust from the horse, either by blowing into the gutter or hollow between the two combs, or by giving it a slight knock above. The socket had a wooden handle, more or less long, inserted in it, and near the rivets which fastened the socket to the body of the currycomb there is a ring which would carry a thong to keep it in its place.

'However, not having other specimens of the kind for comparison, and not being aware of any drawing of a currycomb [or strigil[1]] in the records of archæology or antiquities, I cannot decide even on an approximate era. Still it is reasonable to assign to it the same age as the spur and the horse-shoe, the date of which has been proved by almost positive antiquarian considerations.'

There are here no traces of fire on any object of industry, nor on any of the organic remains, nor on the huts themselves, as may be observed in the lake dwellings of Bourget, which have been lately so well examined by Mr. A. Perrin.[2]

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[1] 'Strigil' is the word in the original paper, but I venture to doubt whether it is properly used in connection with horses.—[Tr.]

[2] 'Etudes préhistoriques sur la Savoie, spécialement à l'époque lacustre (âge du bronze),' Chambéry, 1870, with a fine album in 4to.

The settlement appears to have been voluntarily abandoned, and this explains the rarity of any objects of great interest, the complete absence of money, the perfect state in which the erections were found, at least in those parts which were preserved from atmospheric agency by being covered with water, and by the peat which formed there and covered up the organic remains fallen from the huts. The products of industry which we dig up are only those objects which had been lost during the sojourn of the lake-dwellers, who let them fall into the lake together with the refuse of the kitchen.

It may be taken for granted that the inhabitants of this lake dwelling were obliged to withdraw to the main land, by an elevation of the waters of the lake, a fact which is in a measure proved, as we shall presently see, and which gave rise to the legend of the swallowing up of the city of Ars, which has been investigated by M. Vallier.

It is, I believe, easy to prove that the level of the lake has not only varied in geological times, but also in our own days. By comparing approximately the level of the platforms at Grands Roseaux, situated at the northern end of the lake, with that of the ancient flat ground indicated by the later piles of the principal foot bridge, we shall see that the water has risen about 5½ feet since the buildings were erected. One fact deserves notice, and that is, that this ancient level was produced by the formation of the sluices of Charavines—that is to say, the same works which have dried a part of the station of Grands Roseaux have brought back the lake to the level it had when this settlement was inhabited.

This secular hydrographical change in the beautiful sheet of water of Paladru might possibly be explained by admitting a slow and long-continued accumulation of the white mud which everywhere covers the bottom of the lake, more especially at the southern end near the weir. Several partial landslips, noticeable in different parts of the banks, may also have concurred in producing the effect in question.

These considerations, which are of the highest interest, deserve especial attention, and though the facts have been scrupulously examined, I bring them forward with some reserve. The geological and hydrographical studies which I have carried on for many years in the country, will probably help me to confirm my first hypothesis.

Considerations of another order, such as refer to the manners and customs of the lake-dwellers of Paladru—probably hunters, cavaliers, and warriors—as well as the causes which led them to build houses on the water in the middle ages, are certainly worthy of as much interest as the study of the prehistoric lake-settlers, from whom our Paladru colonists seem to have borrowed this custom of isolating themselves from the races of the mainland.[1]

LYONS: *April* 1870.

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[1] In a postscript by the author after his paper was printed, he states that the water of the lake had been lowered to such an extent that, in September 1870, it was about 6 feet lower than the general average previously. But, probably in consequence of this fact, a series of landslips had taken place which materially altered the lake, and in some parts where the banks had been from 13 to 16 feet high, the whole of the ground with the trees upon it had sunk into the lake, and the water there was 16 or 18 feet deep. This is not the place to discuss a geological fact, but it is mentioned here as it may throw some light on the ancient changes of level in the water, and consequently of the pile habitations found in its shallows.—[TR.]

NOTICES OF THE IRISH CRANNOGES.

ABRIDGED FROM THE ACCOUNT GIVEN OF THEM BY SIR W. R. WILDE, AND OTHER ANTIQUARIES.

THESE stockaded islands, or crannoges as they are called in the Irish annals, have been so fully described, chiefly by Sir W. R. Wilde, in the 'Proceedings of the Royal Irish Academy,' and in his Descriptive Catalogue of this Society's Museum, that it may seem needless to do more than merely refer to his detailed descriptions. Still a work on lake dwellings would be incomplete without some notice of them, and the following account has therefore, by his permission, been extracted chiefly from his reports: some few facts have been added from the observations of other antiquaries.

It is uncertain whether the name of crannoge was derived from the timber employed in enlarging, securing, and fortifying the island, or from the wooden houses erected on it, or whether it was also applied to log-houses on the land. But, although alluded to so early as the middle of the ninth century, it is remarkable that no examination of a single crannoge occurred till the end of the year 1839.

These islands are chiefly found where several small lakes are clustered together. They were not, strictly speaking, artificial islands, but cluans, small islets or shallows of clay or marl, in these lakes, which were probably dry in summer time, but submerged in winter; these were enlarged and fortified by piles of oaken timber and in some cases by stonework. A few were approached by moles or causeways, but, generally speaking, they were completely insulated and only accessible by boats, and it is a singular fact that in almost every instance an ancient canoe was discovered in connection with the crannoge. Being thus insulated, they afforded secure places of retreat from the attacks of enemies, or were the fastnesses of predatory chiefs or robbers, to which might be conveyed the booty of a marauding excursion, or the product of a cattle raid.

It may naturally be concluded from the amount of oaken timber invariably discovered in these stockades that the neighbouring country was well wooded; it is also manifest from the quantity, age, and variety of the antiquities discovered in these crannoges that they had been long occupied. We likewise learn from their recent submerged condition how much water had accumulated on the face of the country since their construction, probably owing to the great decrease of forest timber, and the increased growth of bog. From the additions made to the height of the stockades, and also from the traces of fire discovered at different elevations in the sections made of these islands, it may be inferred that the rise of the waters commenced during the period of their occupation.

The first examined and described was that at Lagore near Dunshaughlin, county of Meath: full particulars of it have been given by Sir W. R. Wilde in the 'Proceedings of the Royal Irish Academy' for April 1840, and also in his Catalogue; and the reader who wishes to know all the details is consequently referred to these volumes. It may be as well, however, here to give a few particulars, abridged from Sir W. R. Wilde's works, for the sake of comparison with the Swiss lake dwellings.

'This crannoge differed from all others since discovered, not being then either submerged or surrounded with water. It consisted of a circular mound, about 520 feet in circumference, slightly raised above the surrounding boggy or marshy ground, which forms a basin of about a mile and a half round, and is bounded by elevated tillage and pasture lands. The lake in which the crannoge was situated has been drained within the memory of man, and the discovery of the crannoge took place in consequence of the large quantity of bones which were found when clearing out a water-way partially surrounding it. One hundred and fifty cartloads of bones were taken away for manuring purposes.

'The circumference of the circle was formed by upright posts of black oak, measuring from 6 to 8 feet in height; these were mortised into beams of a similar material, laid flat upon the marl and sand beneath the bog, and nearly 16 feet below the present surface. The upright posts were held together by connecting cross-beams, and (said to be) fastened by large iron nails: parts of a second upper tier of posts were likewise found resting on the lower ones. The space thus enclosed was divided into separate compartments by septa or divisions that intersected each other in different directions: these were also formed of oaken beams in a state of good preservation, joined together with greater accuracy than the former, and in some cases having their sides grooved or rabbeted to admit large panels, driven down between them. The interiors of the chambers so formed were filled with bones and black moory earth, and the heap of bones was raised up in some places within a foot of the surface.' The animal remains included several varieties of oxen, also swine, deer, goats, sheep, dogs, foxes, horses, and asses. With these there was a vast collection of antiquities—warlike, culinary, personal and ornamental—of stone, bone, wood, bronze, and iron. They consist of swords, knives, spears, javelins, and dagger blades, sharpening stones, querns, beads, pins, brooches, combs, horse-trappings, shears, chains, axes, pots, and bowls. (See the Proceedings of the Academy, vol. i. p. 425, and also the Archæological Journal, vol. iv. p. 101.) Some human remains were also found there.

Soon afterwards numerous other crannoges were discovered, which it would be tedious to enumerate. It will be sufficient to mention that when Sir W. R. Wilde published his catalogue about forty-six were known, viz. twenty in Leitrim, twelve in Roscommon, two in Cavan, six in Monaghan, and one in each of the counties of Limerick, Meath, Westmeath, Down, King's County, and Tyrone.

It may be well here to give the general results of the examination of these crannoges from the reports of the engineers of the 'Board of Works.'

They are surrounded by stockades driven in a circle from 60 to 80 feet in diameter; but in some cases the enclosure is larger and oval in shape. The stakes of these stockades are generally of oak, mostly young trees from 4 to 9 inches in diameter, usually placed in a single row, but sometimes in double and in a few instances in treble rows. The portions of these stakes remaining in the ground generally bear the marks of the hatchet by which they were felled. Several feet of these piles must have originally projected above the water, and were probably interlaced with horizontal branches so as to form a kind of screen or breastwork.

The surface within the staked enclosure is sometimes covered over with a layer of round logs cut into lengths of from 4 to 6 feet. In one instance, at Cloneygonnell, parish of Kilmore, county Cavan, the wood within the enclosure consisted of planks, laid in a radiating form, the interstices being filled with short blocks, small branches, and bark ('Proceedings o

Royal Irish Academy,' viii. p. 274). As a general rule the mass of wood was covered more or less with stones, clay, and gravel. In a crannoge, described by Mr. G. H. Kinahan in Lough Rea ('Proceedings of Royal Irish Academy,' viii. p. 413), a very singular flooring of basketwork was found three feet lower than the present level of the lake; it rested on the mass of timber, but only extended over a part of the area excavated.[1] It was also remarkable that a vertical wall of wattle- or basket-work was discovered, which from the drawing strongly resembles that of Ebersberg, described in the present volume, and drawn Plate CXLIV. fig. 16. An arrow-head of chert from the limestone, a bone piercer, a pair of iron shears, a brass pin, a crosier made of brass, a battle-axe, a hammered iron ladle for smelting, and the mould for a coin made of plaster of Paris, were found here. The last specimen was unfortunately lost. Quantities of bones were met with, of oxen, sheep, goats, deer, pigs, and dogs or wolves, and also, very singularly, the skull of a *Megaceros Hibernicus*. Mr. Kinahan mentions a suggestion by Professor Jukes that this specimen does not prove that the animal lived when the crannoge was inhabited, as it might have been brought there merely as a curiosity.

In some crannoges the platform is confined to a portion of the island. Pieces of oak-framing, with mortises and cheeks cut in them, have sometimes been found within the enclosure.

In almost every case a collection of flat stones was discovered near the centre, apparently serving as a hearth; in some instances two or three such hearths were found in different parts of the crannoge. Generally one or more pairs of querns were met with, and in very many cases large quantities of bones of black cattle, deer, and swine.

Of course it is impossible in a mere cursory notice of these crannoges to give many particulars; the full details must be looked for in Sir W. R. Wilde's works and in the 'Proceedings of the Royal Irish Academy,' especially in vols. vi., vii., and viii. Professor Harkness has described a crannoge in Drumkeery Lough (Archæologia, vol. xxxix. p. 482); and the late Sir M. Digby Wyatt also has brought the subject before the Institute of British Architects.

But though the reader is necessarily referred to the above original works for full information, it may still be advisable to give here a few illustrations which will afford a general notion of these singular structures. Plate CXLVII. fig. 1 is the section of the crannoge in Ardakillin Lough, near Stokestown, county of Roscommon; it is constructed both of stones and oak piling; the top line shows the former highest water level; the second that in the ordinary winter flood; and the third the general summer level. 'The upper layer of the crannoge was formed of loose stones surrounded by an enclosing wall supported in part by piling: the lower portion shows as far as it is possible on so small a scale the original clay, peat, and stones of the island, on which were found in various places, strata of ashes, bones, and logs of timber. The oak piling of different descriptions is shown in section: that driven obliquely being sheet piling which was continuous all round the island.' (See Sir W. R. Wilde's 'Catalogue of Irish Antiquities,' p. 226.)

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[1] May not this so-called basket-flooring have been a portion of the wattle walls which had fallen down?—[Tr.].

Drumaleague Lough in the vicinity of Lough Scur, county of Leitrim, was about a mile in length, and when lowered 13 feet disclosed two crannoges, also a canoe of a single piece of oak, 18 feet long, 22 inches broad, square at stem and stern, and remarkable for having apertures for row-locks cut into the sides.

Plate CXLVII. fig. 2 is the plan of one of the crannoges in this lough, and affords a good idea of the general arrangement of these timber structures. The outer paling of stakes includes a circle 60 feet in diameter, in some places double or treble; there are clusters of stakes in other portions of the island, some of which appear to have been placed with regard to a particular arrangement, A. The central oblong portion consists of a platform of round logs, cut in lengths of from 4 to 6 feet, chiefly of alder timber. B, a collection of stones with marks of fire on them. C, a heap of stiff clay. D, the root of a large tree nearly buried in the peat, the surface of the wood bevelled off with a hatchet, so as to form a sort of table, under which a considerable quantity of bones was found, apparently those of deer and swine.

Plate CXLVII. fig. 3 shows the section of the second crannoge in Drumaleague Lough; it was 72 feet in diameter within the circle of oak stakes, only two of which of course are represented in the Plate. Between these may be seen, in the section, B, horizontal pieces of alder timber, laid upon the natural surface of the island, each log being from 3 to 8 inches in diameter, all water-soaked and rotten. This stratum was 3 feet 6 inches deep. A, a heap of stones, with marks of fire upon them; other hearths were found in different parts of the island. C, the lower stratum of black, rotted sticks and branches of all sorts lying in all directions. This stratum was examined for 4 feet in depth and probably continued yet deeper. DD, two heaps of stones found in the lower stratum. E, a large quantity of the bones of deer, swine, &c., found together about 4 feet below the surface. The circle of this island, which was tolerably regular, was formed by a single row of oak stakes.

To the above accounts we may append a brief notice of a crannoge in the parish of Clogherney, Barony of East Omagh, county of Tyrone. It was investigated by the Rev. Rob. V. Dixon, D.D., Rector of Clogherney, to whom we are indebted for the following particulars. 'It presents some peculiarities, and no account of it has as yet been published. It was found in a bog on the borders of Roscavey and Clogherney Sliebh; it lay in a hollow, running nearly east and west between two sloping hills. The fall of this hollow is towards the east, where it spreads out and sinks into a large basin or glen, closed by rising ground of considerable height to the north and east, and by a gravel ridge or "Esker" on the south, and opening on the west into the hollow in which the crannoge stood. A considerable mountain stream enters this basin from the east, and after flowing round a conical gravel hill (connected with the Esker) which stands in the middle of it, escapes through a deep natural cut or gap in the Esker, which, as before mentioned, closes the basin on the south. If this cut were closed the basin would be filled up by the stream which now flows through it, and the level of the water would probably rise up sufficiently high to fill the hollow in which the crannoge stood, and this hollow would then form a shallow arm of the lake. The crannoge was found on cutting away the bog which had grown over it. About 8 or 10 feet below the surface the workmen came on the top of a row of oak planks, forming a circle about 70 feet in diameter. The planks were roughly split from the log, and were from 8 to 14 inches wide, and from 3 to 5 inches thick. When discovered they were about 4 feet long, but they had, to all appearance, been originally longer, as their tops were all jagged and decayed, as if the upper part had rotted away. The lower ends were rudely pointed and sunk some 10 or 12 inches in the clay. Each plank had a rude square hole cut in it, evidently formed by a blunt tool, most probably a metal one, wider on both the sides of the plank and narrower in the middle. Several rough logs of soft wood, alder, birch, &c., from 2 to 4 inches in diameter, were laid horizontally against the lower part of the planks on the inside of the enclosure. In the centre of this enclosure was found a floor formed of oak planks with some 18 inches or 2 feet of turf below it, and between this floor and the outer fence were several flagstones, evidently used as hearths from the quantity of pieces of charred wood found about and beneath them. The planks forming the enclosure were placed edge to edge and in close contact. The entrance was to the south and was marked by two square posts.

'There are some points connected with this crannoge which present peculiar difficulties. Unless, as described above, the cut in the Esker was closed, by which the basin or glen is drained, this structure never could have stood in a lake, and if it had not this security there appears no reason why a structure of its peculiar character should have been erected there. Again, it does not appear how the heavy planks forming the enclosure were originally supported and secured; for they were not more than 10 or 12 inches deep in the clay; nor is it easy to conjecture what was the use of the mortise holes, cut with such labour in them, and which were just on a level with the surface of the clay or below it. Again, it is difficult to understand what preserved the existing four feet of these planks perfectly sound while the upper part rotted away. If they were originally set up in bog of that depth indeed, their preservation would be accounted for while the portion above rotted, and bog to the extent of 8 or 10 feet was subsequently formed over them; but there are several objections to this view.'

A large number of the antiquities found in the Irish crannoges have been figured and described under their various heads by Sir W. R. Wilde in his Catalogue and in the 'Proceedings of the Royal Irish Academy'; also in vol. iii. page 44, and in vol. vi. page 101, of the Archæological Journal: these must be referred to by those who wish to study the crannoges carefully. But, in order to give some idea of the nature of the objects found in them, a selection has been made from the above-named sources and given in the lower part of Plate CXLVII.

Figs. 4, 5, and 6 are bone cloak pins from the crannoge of Ballinderry in the county of Westmeath; the two first are each made of two pieces; the shank is made with a shoulder on which the flat portion is fixed which forms the head. Fig. 4

is 4½ inches long, and the circular head is 1 inch in diameter. Fig. 5 is 3⅛ inches long. The pin drawn Fig. 6 is square in the shank and has a looped head, through which is passed a ring also of bone. It is 5½ inches long, is highly decorated all over, and is so sharp both in the carvings and at the angles as to lead to the belief that it had never been in use.

Fig. 7 shows the head of a bronze pin, the size of the original, found at Ardakillin crannoge.

Fig. 8 is the drawing of a rare type of bronze pin; it has three rings passed through apertures in the elongated head; it is 3 inches long, and was found in the Dunshaughlin crannoge.

Fig. 9 represents a triangular piece of coarse white sandstone with hollows on both sides to form moulds for castings; upon that represented, we find the mould for a simple celt 3 inches long; and another for one 4 inches long with a cross stop and a ring for attachment to the shaft. This stone is 7¼ inches long. It was found in the Lough Scur crannoge in the county of Leitrim.

Figs. 10, 11, 12, 13, and 14 were all found in the crannoge of Lagore, near Dunshaughlin. Fig. 10 is an iron spearhead 10 inches in length. Fig. 11 is a double-edged sword of iron formed with a central ridge, and 15¼ inches long. Fig. 12 is also a double-edged iron sword, 22¼ inches long, including the strig or tang which passed through the hilt; the blade is 18½ inches long, 1⅓ inches wide, and is formed with a wide shallow groove or channel along its entire length.

Fig. 13 is a blade of iron curved towards the point, in some degree resembling certain Oriental weapons; the curved portion alone has a cutting edge, and this is the case on both sides. Fig. 14 is an iron knife.

It now only remains to give very briefly a few extracts from Irish annals, with their dates,[1] in order to show that history is not silent respecting them.

A.D. 848. Cinaedh, son of Conaing, lord of Cianachta-Breagh in Meath, went with a strong force of foreigners, plundered the island of Loch Gabhor, and afterwards burned it so that it was level with the ground. ('Annals of the Four Masters.') Thus we see that Lagore crannoge was occupied a thousand years ago.

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[1] Sir W. R. Wilde (Proceedings of Royal Irish Academy, vii. p. 148) mentioned amongst other things found at Derry Hollow, a coin of Charles II., probably, as he says, fixing the date of the latest occupation of this crannoge. From the pottery found in the crannoges generally Sir W. R. Wilde thought that they were probably occupied from the ninth to the sixteenth century. 'Between this period,' he says, 'and the prehistoric times of the sepulchral urns, we have not the slightest vestige of pottery.' It must be confessed, however, from what is stated in this account, that pottery seems to have been very much neglected in excavating crannoges.

A.D. 1246. Turlough . . . made his escape from the crannoge of Lough Leisi in autumn, having drowned his keepers. ('Annals of the Four Masters.')

A.D. 1436. The crannoge of Lough Laoghaire, near Clogher, in Tyrone, was taken by the sons of Brian O'Neil. ('Annals of the Four Masters.')

A.D. 1512. Philip Maguire made an incursion into Tullyhaw, county of Cavan, and from thence they proceeded to the crannoge of Magauran which they took. ('Annals of the Four Masters.')

A.D. 1603. Hugh Boy O'Donnell, having been wounded, was sent to Crannog-na-n-Duini, in Ross Guilt, to be healed. ('Annals of the Four Masters.')

It is needless to multiply quotations, and this short notice of the Irish crannoges may be closed with the words used by Mr. Shirley;[1] 'The crannoge was the universal system of defence in the north of Ireland.'

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[1] Shirley's 'Account of the Territory or Dominion of Farney.'

CRANNŌGS—IRISH LAKE DWELLINGS.[1]

By G. H. Kinahan, Esq., M.R.I.A.

According to O'Donovan a crannōg is 'a house of timber built on a lake.' When typical the Irish lake dwellings are round or oblong, but sometimes more or less irregular structures or islands, surrounded by one or more systems of piles. Sometimes a small island in a lake was enlarged, but generally

Fig. 45.

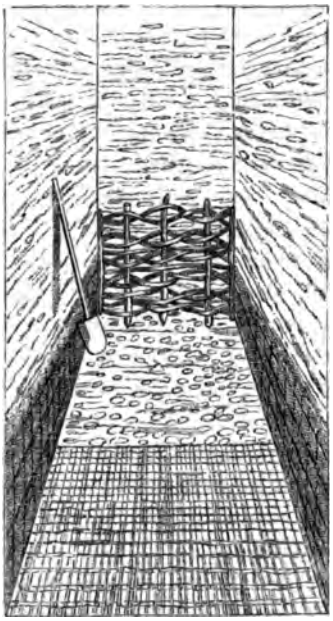
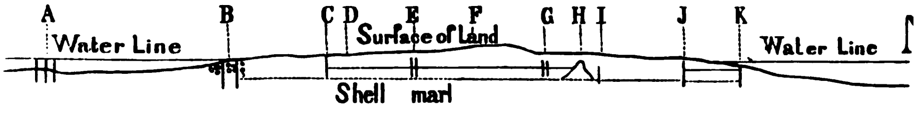


Fig. 46.



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[1] I am indebted to my friend Mr. Kinahan for this epitome of the Irish crannōgs. It was made expressly for this work. No one knows more about crannōgs than Mr. Kinahan. Mr. Kinahan spells the word somewhat differently from Sir W. R. Wilde, but of course the author's spelling is adhered to in his own paper.—[J. E. L.]

it would appear as if artificial islands had been constructed in shallow places, the space inside the piles being filled in with sods of turf, branches of trees, and stones; while on the islands houses were built. These houses were a combination of wooden upright poles, wickerwork, and sods, with boarded, basketwork, or paved floors (see the woodcuts 45 and 46, the latter being a section), and in many cases they appear to have been built round the margin, leaving an open space in the centre of the island.

Many of these crannōgs have among or outside the encircling piles a quantity of stones, to strengthen the structures and protect them from the wash of the waves.

A few of the crannōgs were constructed somewhat similar to the Swiss lake dwellings, the houses having been built on wooden platforms that were supported on piles or faggots; and when the latter were used they were weighted with stones to keep them in position; such a crannōg seems to have been built in Loch Cimbe (now Loch Hackett) county Galway, as we learn from the annals that two or three times it was blown away. Subsequently, however, the occupiers were compelled to add to it yearly boat-loads of stones, thus forming the island which now exists. In the places where such crannōgs, without encircling piles are found, the platforms subsequently became gradually embedded in lacustrine accumulations.

In those districts where wood was scarce, the lake dwellings were constructed of stone, having a form similar to the *cahers* or stone forts. The largest and best examples of stone crannōgs or island *cahers*, is Hags Castle, Lough Mask, county Mayo. In latter ages the wooden houses on the crannōgs were replaced by stone buildings, some of which were castles, as that at Ballynahuish, West Galway.

A few crannōgs are joined to the land by causeways, but in general they are islands, and, commonly, near them are found the remains of one or more canoes, dug out of a log of timber.

Of the time when the crannōgs were first built there is no known record, but that they must have been inhabited at an early period is evident, as antiquities belonging to the stone age are found in them. Some were in use up to modern times, Crannough Macknavin, county Galway, having been destroyed in A.D. 1610, by the English, while Ballynahuish Castle was inhabited 50 years ago. Some crannōgs seem to have been continuously occupied until they were finally abandoned, while others were deserted for longer or shorter periods. In Shore Island, Lough Rea, county Galway, there is a lacustrine accumulation over 3 feet thick, marking the time that elapsed between two occupations.

In Wakefield's Island, A.D. 1812, attention was directed to a crannōg in Lough Nahineb, county Tipperary; but to the late Sir W. R. Wilde, M.D., is due the credit of bringing these structures prominently under public notice. This observer records 46 crannōgs (Catalogue, Royal Irish Academy, vol. i. pp. 220 *et seq.*), but since then twice as many have been recorded, most of which are described in the publications of the Royal Irish Academy, or kindred societies; but a systematic classification of the crannōgs has yet to be made.

NOTICES OF THE SCOTCH CRANNOGS.

By John Stuart, Esq., Secretary of the Society of Antiquaries of Scotland.

The discovery of crannogs[1] in Ireland, and of somewhat similar lacustrine remains in Switzerland, concurred to draw attention to the subject in Scotland, when for the first time the scattered notices of piled islands, some of which had been recorded for many years, took shape and revealed the fact that the system of stockaded islands had at one time been common in many parts of the country.

Mr. Joseph Robertson was the first who brought the subject of Scotch crannogs under the notice of archæologists in a paper which he read in December 1857 to the Society of Antiquaries of Scotland, entitled 'Notices of the Isle of Banchory, the Isle of Loch Canmor, and other Scottish examples of the artificial or stockaded islands called Crannoges in Ireland, and "Keltische Pfahlbauten" in Switzerland.'

A discovery of a group of artificial islands in the Loch of Dowalton in Wigtonshire occurred in the autumn of 1863, and was described by Lord Lovaine, now Earl Percy, in a paper read to the British Association at its meeting at Newcastle in September of that year.

At this time the drainage of the Loch of Dowalton was not so far advanced as to allow a complete inspection of this group of islands. About a year afterwards, however, when I visited the place, the whole bed of the loch was exposed, and the islands were approachable.

I was so much interested in the subject that I was induced to prepare for the Society of Antiquaries of Scotland a paper giving a detailed account of the construction of the Dowalton

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[1] In these notices, which the late Mr. Stuart kindly prepared expressly for this translation of Dr. Keller's lake dwellings, he spells the word 'crannog.' In other parts of this volume the word is spelled 'crannoge,' which on the whole I prefer, as being probably the more usual mode. As, however, these notices have been kindly furnished by Mr. Stuart, his spelling of the word has of course been followed.—[J. E. L.]

Islands, and of the remains found in them; and as Mr. Robertson's other engagements had prevented him from amplifying his paper, and adding to it accounts of other crannogs which had come to light since it was read, I took the opportunity of incorporating in my descriptions all the facts which I could glean, so as to afford a basis for comparing the Scotch examples with those in other countries. This paper was read to the Society in the month of March last, and since that time Mr. Robertson handed to me his paper and notes, of which I have made use in preparing my own manuscript for the press.

The lacustrine remains of Scotland admit of a certain classification. There are, first, crannogs proper, by which I mean islands in lakes, artificially formed on wood or surrounded with wooden piles, of which, including the group in Dowalton, about thirty-five are known.

Then there are sites in marshes where vestiges of piling, or other indications of former crannogs, have been found, and of these there are ten.

Besides these, we have in many lakes natural islands which have been fortified principally by barriers of stones surrounding them and by causeways leading from them to the shore, and these are very numerous.

Of the first class, or the crannog proper, the ordinary construction was by logs of wood in the bed of the lake supporting a structure of earth or stones, or of a mixture of both, the mass being surrounded by piles of young oak trees in the bed of the lake, the inner row of which kept the island in shape, and the external rows acted as defences and breakwaters.

The crannogs at Dowalton were differently constructed. The surface of the islands was of stones resting on a mass of compressed brushwood, below which were large branches and stems of small trees, mostly hazel and birch, mingled with stones, apparently for compressing the mass. Below this were layers of brushwood, fern, and heather, intermixed with stones and soil, the whole resting on a stratum of fern which lay on the bed of the loch.

Some of the islands were surrounded with beams of oak mortised into each other and laid in a sloping position to the outer edge, and were probably intended as breakwaters, and occasionally planks of oak with grooves in them were noticed. Several canoes formed of oak from 21 to 25 feet in length were found in the loch. One of them was discovered under the foundations of a crannog.

On the larger islands great quantities of the teeth and bones of animals were found, principally of the ox, pig, and goat.

Various articles were picked up on the islands and their neighbourhood. Amongst these was a bronze dish with a handle. It measures 8½ inches in diameter at the mouth and 6 at the bottom, its depth being 5½ inches. The handle is 7 inches long and is stamped with the letters CIPIPOLIPI. The vessel corresponds in style and workmanship with bronze patellæ found on Roman sites in various parts of England.[1]

Several other dishes of bronze were found, some of them much mended. Of ornaments there appeared beads of glass, one of amber, a small brooch of bronze, and bits of armlets of enamelled glass. There were several iron hammers, whetstones, a small earthen crucible, querns, and pieces of slag.

All the articles were collected by Sir William Maxwell, of Monreith, who has presented them to the national museum of the Antiquaries of Scotland.

On a rising ground near the loch is a rath, in which respect it agrees with numerous Irish examples, where raths are found on the shores of lochs containing crannogs.

A curious structure of the nature of a crannog has recently been noticed in a moss on the estate of Jardine Hall, belonging to Sir William Jardine, Bart., but as yet has been only partially examined. It was discovered while digging for peat in a bank of from 12 to 14 feet in height, and consisted of a large number of oak trees lying parallel and close to each other, forming a sort of platform, with 6 or 7 feet of peat below and as many above it.

The portion of the platform as yet uncovered is from 20 to 30 feet wide, while the ends of the trees can be followed in the face of the bank for at least 150 feet. The platform is covered with twigs of birch, and above this a layer of common bracken.

This layer of birch, twigs, and bracken is about 10 inches thick, and appears uniformly to cover the platform except at one point, where flattish whinstones are laid on as a sort of pavement over the trees, the space so covered being an irregular circle of 6 or 7 feet in diameter. On this spot, fragments of burned wood were very numerous, and beside it were found seven large 'bowls' or cups cut out of oak, and a rude oak mallet with a branch as a handle. The 'bowls' were from 10 inches to 1 foot in outside diameter. The logs and twigs were all cut as if by a sharp instrument, and two of the logs had mortise holes cut in them from 2 to 3 inches square.

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[1] A Roman station was placed at Withorn, the Candida Casa of Bede, about four or five miles from Dowalton.

I hope to examine this curious structure with care when it is divested of moss, which will be soon. My information at present has been derived from Sir William Jardine and Dr. Arthur Mitchell.[1]

JOHN STUART.

August 1865.

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[1] I am tempted here to insert an extract from a letter lately sent to me by the Rev. C. W. King, and my friend will pardon me for copying it exactly as it was received; any alteration of his epistolary style would weaken the force of his acute remarks: 'Did it never strike you, when Cæsar talks of the Morini taking refuge in their marshes, and Dio Cassius of Severus pursuing the Caledonii into theirs, in which he lost 50,000 of his own troops, that such facts presuppose the existence of pile fortresses, or at least of *crannoges* in these morasses? for these Celts required a "pied à terre" literally, to enable them to hold out any time in such situations; they could not squat for weeks like a flock of wild ducks upon the surface of the morasses.'—[TR.]

ON A CRANNOGE, OR STOCKADED ISLAND, IN LLANGORSE LAKE, NEAR BRECON (SOUTH WALES).

By the Rev. E. N. Dumbleton, M.A.

My present task is to give an account of a *crannoge*, or ancient island-dwelling, which, in company with some friends, I have recently examined in Wales. I need but mention that, for the last seventeen years, the relics of the lake-dwellers in Switzerland have attracted no little interest abroad, and there as well as here have impelled research and speculation as to the age and character of these, the earliest occupants of Europe. The remains of pile-habitations and of stockaded islands, such as I am about to describe, have come to light also in Ireland and Scotland; but I am informed that up to this time little, if any, trace of them has been found either in England or in Wales.

Immediately beneath the southern spurs of the Black Mountains, and in the hollow of the great geological fracture which parts that chain from the Brecknockshire Beacons, is situated a sheet of water now called the Lake of Llangorse. Its name was formerly Llyn Savathan, or the lake of the sunken land. The area of water was once far more extensive than it is now; and it has subsequently been, as I think, considerably less than at present. A circuit of five miles will now enclose it. The margin is flat and swampy, except on the north-east, where the mountain descends upon the shore-line somewhat abruptly. The depth, though by vulgar report vast and fearful, Leland has rather overstated in assigning to it thirteen fathoms.

Within a bow-shot of the flat meadows on the north side there is an island, that would appear but little above the water were it not for some small trees and brushwood that have fastened upon it. Plate CXLVIII. fig. 2, is a vignette of this island, together with the mountain to the north.

Concerning this lake strange stories have long been current. Giraldus Cambrensis, in Henry II.'s time, relates phenomena which were in his age regarded as supernatural. Before Leland's time the Roman *Loventium* was thought to be covered by its green, weedy surface; while to the present day a most persistent legend obtains, that men once lived where now is water.

Sailing by the island one day in 1867, I observed that the stones which stand out on the south and east sides were strangely new-looking, and most unlike the water-worn, rounded fragments that on the main shore have been exposed to the action of the waves; neither did there seem to be any original rock-basis at all. It was, in fact, nothing less than a huge heap of stones thrown into water two or three feet in depth. Was this the key, I thought, to the old tradition of a city in the lake? In the summer of last year, my brother, then living in the neighbourhood, first discovered a row of piles or slabs; some standing a few inches above water, for the lake was very low. We have together made some investigations during the past month, the results of which I will detail.

The island, as now above water, measures 90 yards in circumference; its form, as may be seen from the annexed plan (fig. 1), being that of a square with the corners rounded off. The highest part is nearly in the centre, and is 5 feet above the water-level. The sides most exposed to weather, and where also the water is deepest, are composed of stones sloping into the water, and extending to the distance of 15 yards from the edge. Under the water, however, they are not nearly so thickly strewn as above. It is remarkable that on the leeward or northern side, as shown on the plan, about one quarter of the island is almost destitute of the stone protection with which the greater part is covered. There is simply a surface of vegetable mould, inclined towards the water. Neither in the water, which is there very shallow, are there more than a score of stones to be found on that side.

I must now speak of the piles. These are of two sorts; the most obvious being either at the margin, or within a few feet of it. One of them is drawn on the Plate (fig. 6). Like the stones, they are most numerous where the action of the storm would be most felt, and upon the shallow side they disappear entirely. They have been disposed in segments of circles, the stones being heaped inside them, and thus saved from being torn away by the waves. These piles (or rather slabs) are of cleft oak, and have been pointed, as it seems, by cuts from a metal adze. We have counted about sixty. They have been driven tightly into the shell-marl, to the depth of 4 feet. There are also other piles, of which I shall have to speak again, which are round, generally of soft wood, and are found outside the present edge of the island. Several are in water 2 feet deep, and are driven into the marl only 12 or 18 inches. These would have been quite powerless to confine the stones, and were evidently for another purpose.

The examination of the interior would, of course, unfold the process of the construction. We therefore made several perpendicular openings; and these invariably led us down to the shell-marl, showing first a stratum of large, loose stones, with vegetable mould and sand; next (about 18 inches above the marl), peat, black and compact; and beneath this, the remains of reeds and small wood. This faggot-like wood presented itself abundantly all round the edges of the island, and in the same relative position, namely immediately upon the soft marl; the object of it being, of course, to save the stones from sinking.

On digging through the before-mentioned low portion of the crannoge, a different order of materials exhibited itself. As I said, the stones are very few; the depth is three feet instead of five; eighteen inches of vegetable mould; six inches of earth mixed thickly with charcoal; and one foot of peat, small wood, or reeds. (Fig. 4.) I may here say that this charcoal is found under water, in very frequent small fragments, on this north-eastern side; and is covered, not with marl or stones, but with sand.

I will now leave the subject of the construction, and speak of the more special articles, the discovery of which, though not so copious as we had hoped, indicate human occupation.

Bones are found in numbers amongst the stones where the water is quite shallow; every spadeful of marl, in some parts would, as the water dripped off, show one or more small bone fragments or teeth. Some of these were sent to Professor Rolleston of Oxford, who wrote that 'the chief points of interest respecting them were, first, the presence of two varieties of horse—one small, such as a Welsh pony is; and the other large (as I am informed large horses appear to have existed, as well as mere galloways, in the very earliest human periods in this country): and secondly, the smallness of the then ordinarily eaten mammals, *Sus*, *Bos*, *Ovis*. The horse was eaten formerly, especially by the pagans, and it may have been eaten by the inhabitants of your crannoge; but there is no evidence, from splitting or burning, that they did so. I have not found any deer, dog, fox, wolf, marten, or other mammalian bones than those I mention—horse, pig, sheep, cow; nor any bird, nor other bones of any kind, amongst those you have sent me.' Some other bones, found subsequently, were exhibited at the meeting of the British Association at Exeter, and were examined by Mr. W. Boyd Dawkins, who pronounced them to be those of the red deer, the wild boar, and the *Bos longifrons*. He stated that the group altogether, from the greater percentage of wild than of domestic animals, indicated a remote period.

The greater number of these bones, and nearly all the larger, were found about the low, shallow side. By far the most had been cracked longitudinally. The larger of these were but slightly covered by any sort of sedimentary deposit. In the excavations bones were plentifully turned up from the interior, except in the middle, and this at all levels. Some wet and fresh-looking, almost touching the shell-marl; some in the peat, some among the charcoal, some amid the earth and stones which approach the surface. Near to the lowest stratum we came upon a bone which at first was taken for an awl; but which, in fact, is in its natural form. It may, however, have been used as a perforating instrument; for in close proximity to it was found a piece of leather pierced with several holes, in some of which, when discovered, the remains of a thong might be observed. Three or four scraps of pottery we groped up, and one stone that seems to have been ground.

I must now return to the structure, and mention some facts in answer to the question, where did the people of this island live? and whether with land or water under them? That they should have lived in so small a place, in numbers equal to the hands employed in its building, is beyond credit. It should be stated, too, that until about seven years ago, when the lake was artificially lowered a foot and a half, this island was not half its present size.

As I before mentioned, there are evidences in favour of a still lower level of the water, when, therefore, the island would have been larger than now. They are as follow:—1. It appears reasonable to suppose that the flat, stockading piles which were used to secure the stones and mould were placed at the water's edge, where they would have best defended the heap within. As they now are, the outer ones are useless, being in a foot of water. There are no stones in contact with the principal ones on the eastern side, and never have been. There is faggot-wood, which would have served well enough to support sand or mould, if above the usual reach of the water; and which, I imagine, has been since washed away.

2. I would refer to the vast numbers of large stones scattered about within a circuit of ten or fifteen yards from the present island-shore. It can hardly be thought that these, conveyed with great labour, would have been thus wasted. They are in water often of eighteen inches or two feet in depth. Supposing that some would naturally have been thrown in as a breakwater, this would account only for those immediately around the actual island; the rest may have been used to keep down, in their place, brushwood and reeds which are found about them, but could never have served any purpose under water.

3. A third reason for supposing the water to have been once lower than at present is suggested by the north shore adjoining the island. There one may observe an accumulation of prostrate trunks and branches deeply embedded amid peat and decomposed reeds. This has not been produced by any suddenly swollen stream or driving flood. Such would have marked its way by gravel and sandstone boulders, and these are totally wanting. Here, it is evident, there was once a thick wood standing beneath the present water-level, and over this vegetable soil and clay have followed. In confirmation of this I would mention the fact of an alder-tree stem which I found upright, I believe, in the place where it had grown from the first, and now beneath one foot of water. (Fig. 3.)

It is clear, as I think, that the waters of the lake have risen; and I cannot resist the idea that this change of level connects itself most forcibly with the tale of the sunken city, for with any considerable rise of the water, the dwellings would have become untenable, and gradually would have perished.

To return, however, to the question of the dwellings. Is it not likely that the island itself was a central, common ground? and that the habitations were projected from its edge towards the water, and were supported by the thick, round piles to which I alluded? Something like a ring of these is found near the oak slabs before mentioned; and traces of a second set are at the distance of twelve or fifteen yards, in water about two feet deep. Between the two, small wood is found abundantly, a few inches in the marl. At about ten yards from the shore, and in two feet of water, there appear to be the actual remains of a sunken platform. Three trunks of soft wood lie nearly parallel to one another. A six-feet stem of oak, which

I cannot account for, was with them. The top of this we sawed off (fig. 5), as it exhibits the marks of some heavy cutting instrument where, in modern days, a saw would have been used.

I have but to add to this subject the discovery of two much more perfect platforms in a perplexing situation, namely within the oak slabs. They were composed of eight straight trunks, about six inches in diameter, lying side by side. Their direction is from the centre to the water; their ends, towards the shore, are thrust against the slab-piles; others are closed in one case by a transverse oak beam. I am inclined to doubt whether they were not once much longer; projecting, perhaps, above the oak piles. And I think, too, that here there is another sign of the island having been once higher; for this structure, before the recent drainage, would have been covered all the year round. The interior ends of these trunks, however, are *in situ*, because they are still covered with large stones.

These conjectures I hope hereafter to test by a further examination of the crannoge. The facts, which I have described as accurately as I could, will, I trust, be regarded as a contribution of some interest to the subject of lake dwellings.

E. N. DUMBLETON, M.A.

LAKE DWELLING IN ASIA MINOR.[1]

ALTHOUGH the following information is exceedingly scanty, still any record of a pile-settlement so much to the east of the district where these dwellings have hitherto been found ought not to be omitted in the present work.

In the '*Allgemeine Augsburger Zeitung*,' No. 122, of the 2nd May, 1859, there is an article entitled '*Beschreibung von Armenien*.' The following are the chief points which bear upon the present subject:—'On the borders of Russia and Asiatic Turkey there are many interesting localities, and even a prehistoric age is indicated by the lake dwellings which beyond any doubt existed in the Gocktscha Lake.

'There are in this district both large and small sheets of water which are entirely wanting in the mountainous district of the isthmus between the Black Sea and the Caspian. Some of them are veritable crater-lakes, and are situated on the watershed between the rivers Araxes, Kura, and Euphrates. They are from 5,800 to 6,500 English feet above the sea. The Great Gocktscha or Lewanza Lake covers a very large area, and is about 6,330 feet above the sea. The Tschilder, on Turkish territory north of Kars, is 6,500 feet above the sea.'

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[1] Communicated by letter from Dr. Keller.

APPENDICES.

APPENDIX A.

REMARKS ON THE BOOK ENTITLED 'HABITATIONS LACUSTRES DES TEMPS ANCIENS ET MODERNES,' PAR FREDERIC TROYON.[1]

I CANNOT refrain, in conclusion, from making some remarks on the above-mentioned volume, and I am quite satisfied that they will be considered both correct and necessary by every Swiss antiquary who has studied the phenomena of the lake dwellings, not merely in the account given by the journals but from actual observation.

In the work referred to it is brought forward as a notable discovery, not only that all our lake dwellings are to be divided into those of the stone, the bronze, and the iron ages, as well as what are called those of the transition periods from stone to bronze, and from bronze to iron; but that the introduction of bronze into the lake dwellings coincided with the immigration of a new people totally different from the primitive inhabitants, and, again, that the diffusion of iron implements coincided also with a change of the population.

According to this classification, the settlements of Eastern Switzerland belong to the stone age, viz., those in the lakes of Constance, Pfäffikon and Moosseedorf. And as bronze is found, though in small quantities, in the settlements of the lakes of Zürich and Sempach, as also at Concise in the lake of Neuchâtel, these lake dwellings are to be placed in the transition period from stone to bronze. The greater part of the settlements of the lakes of Bienne and Neuchâtel together with those of the lake of Geneva are said to belong to the bronze age, while some in the lakes of Bienne and Neuchâtel fall under the transition age from bronze to iron, or rather under what is called the first iron period—that is, the Helvetic.[1]

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[1] At first it appeared to me that these remarks might have been omitted in an English translation of Dr. Keller's works on the lake dwellings, but a little consideration convinced me that the original discoverer of the 'Pfahlbauten' would not have justice done to him if they were suppressed. M. Troyon's book having been written in French has obtained probably a wider circulation in England than Dr. Keller's notices, which were written in German; and though almost entirely based upon them, yet in many respects gives such a different version that it seems but fair that Dr. Keller should point out the discrepancies, as otherwise he might be implicated in the conclusions of M. Troyon, from many of which, as it will be seen, he entirely dissents. These notices, however, are put in the Appendix, so that they may easily be passed over by anyone not interested in the discussion.—[TR.]

The condition of the population at the different periods is represented in this volume in the following manner :—

'The people of the *first period* were entirely ignorant of the use of metals. Hunting, fishing, cow-keeping, and some small amount of agriculture, afforded the means of subsistence. Flax and hemp were cultivated for other requisite purposes; barter was carried on with foreign lands. Industrial skill was in a very primitive state, for the small stone hatchets as yet show no artificial perforation, and the productions of the potter's art exhibit neither the elegant forms nor the variety of ornamentation of the later ages. This first period is said to have come to a sudden end by the irruption of a people provided with bronze implements. The lake dwellings were burnt by these new comers,[2] and the primitive inhabitants were slaughtered or driven back into remote places. This catastrophe affects chiefly the settlements of East Switzerland, which entirely disappeared, and also a number of those on the shores of the western lakes; some few settlements, however—namely, those of the so-called transition period—are said not to have been destroyed by the new people till after the inhabitants had begun to make use of bronze implements.

'*Second period.*—A new era as to the lake dwellings begins, according to this work, in Western Switzerland with the sudden appearance of bronze, for Europe is said not to have known a copper age. It is, however, not the new people who have now got the land in their possession, but the old population, which was not entirely destroyed, and gradually became united with the rulers of the country; they again appeared on the lake dwellings and continued their former manner of life. The diffusion of bronze, at first occurring only in imperfect productions, caused a rapid development of civilisation; the conditions of life became favourable; the dwellings were better constructed; industry made great advances; the working of leather, the art of weaving and that of making garments, were much benefited by implements of metal. The products of the potter's art received new and elegant forms and fresh modes of ornamentation; attempts were also made in casting. New stations were erected, and those destroyed were restored from the lake of Bienne to that of Geneva. The images or figures, relating to moon-worship, are said not to belong to the bronze but to the iron period. Burning the dead is also stated to have been introduced by the new people. Population increased in the lake dwellings,[3] but it is asserted to be of a different race from that which at the same time inhabited the mainland of Eastern Switzerland in the bronze period. This second period is made to come to an end in a similar way by the destruction of all the lake dwellings.

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[1] The Allobroges who lived on the banks of the lake are classed amongst the inhabitants of lake dwellings (of the first iron period), though Suidas, ii. 64, does not say a syllable about their habitations.

[2] The clay balls, which in the 'Habitations lacustres' are considered as incendiary missiles to set fire to the huts, are nothing else but weights to fasten to the threads in the loom.

[3] From the curve of some few pieces of the clay covering of the huts, not more than a foot across, which fell into the water red hot when the dwellings were burnt, and

'*Third period.*—Again a new people appear on the scene, fighting with iron weapons; as they are said to come from a country without lakes they do not occupy the lake dwellings. The two elements of the ancient population are subjugated, decimated, driven into the mountains, and the lake dwellings are burnt down. However, again some few families of the primitive population escape this second tempest. About a dozen lake dwellings spring up on the shores of the lakes of Bienne and Neuchâtel, the inhabitants of which adopt the manner of life of the second conquering race; instead of the regular lake dwellings, miserable huts are erected in which the fishermen's families eke out a wretched existence. The remains of pottery show that these abodes were still inhabited in Roman times. The population of the third or iron period are said likewise to have burnt their dead, but to have deposited their ashes in urns under sepulchral tumuli.

'The following are said to have been the names of the people of these different periods. The population of the first period are a primitive people, perhaps belonging to a Finnish or Iberian race which came out of Asia several thousand years before our era, and following the course of the Rhône or the Rhine wandered into the valleys of the Alps. The people of the second period are the Celts, who likewise came out of Asia. The weapons used by them in attacking and destroying the lake dwellings were of bronze, for in their own country they had attained to great skill in working this metal. The people of the third period are the Helvetii, who left their abodes in South-western Germany. They are more advanced in civilisation; they slaughter the earlier inhabitants with swords of iron, and destroy the lake dwellings which had been established afresh in Western Switzerland.'

Such is the account given in this volume of the condition of the population during the different periods, and such is represented as the fate of the inhabitants of the lake dwellings.

I am about to bring forward some objections to the division of the lake dwellings into those of the stone, the bronze, and the iron periods, so far, at least, as they are said to coincide with the appearance of different nations, and to show that a sudden leap from one class of civilisation to another cannot be proved by investigating the remains of the lake dwellings, but that the metals became gradually spread amongst the settlement like any other article of trade. Before doing this, however, I must first be allowed to make some corrective remarks, respecting

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were thus fortunately preserved, and which from this or some other cause have been bent, the author of the 'Habitations lacustres' calculates the circumference of the huts, makes them fitted to hold four persons, estimates the number of huts on an entire lake settlement, and lastly, determines the amount of the population contained in it the account given of their geographical division, and also as to the picture drawn of the manner of life amongst the inhabitants.[1]

In the first place, with respect to the geographical distribution of the lake dwellings of the stone and bronze ages, and the opinion that the modern limits between those parts of Switzerland distinguished by speaking French or German could possibly mark in like manner the boundary between the settlements of the stone and bronze ages, this view is gainsaid by the situation of the lake dwelling of Peschiera, especially belonging to the bronze age, which lies far more eastward than the stone settlements of Eastern Switzerland; the settlement of Moosseedorf also, which is essentially of the stone age, is surrounded by places which were furnished with bronze either in a smaller or larger quantity; and, again, the bronze implements lately found in the settlements on the lake of Constance, and on the south side of the Rosen-insel in the Starnberger See near Munich, show the futility of such a division. It is also equally impossible now to draw a definite line of demarcation between the lake dwellings with or without iron, as Inkwyl; and the lakes of Sempach and Mauensee do not belong to West Switzerland, and yet have afforded implements of iron.

With respect to the conditions of life of the first period, the results of investigations in the lakes of Pfäffikon, Niederwyl, and Constance, show that cereals in general formed the chief article of food;[2] moreover, that hemp was not grown at all, but that flax, on the contrary, was cultivated to a great extent, and was worked with so much skill that the variety of woven linen cloth made with such imperfect mechanical aids actually astonishes us. We may conclude with all certainty that the clothing of the colonists of the stone age consisted chiefly of thinner or thicker linen cloth. With respect to the handicraft ability of the settlers, so far as implements of stone are concerned, not the slightest difference can be seen between the products of this first period and the following one, or the so-called transition period; for precisely the same forms are found in the earlier age and in that when bronze begins to appear; and not only so, but perforated and even ornamented stone celts are found more commonly in the stone period, and more especially at St. Aubin, a station of the pure stone age. The pottery of the first age indicates considerable dexterity in working clay, and consists of vessels and cups of various forms with the commencement of the very same ornaments which cover the productions of the later period.

The assertion that all the lake dwellings of the stone age were burnt down by the irruption of a foreign people is not correct, for at Niederwyl and several lake dwellings of the Unter See no traces of fire have been observed. The fact that in all the lake dwellings of the stone age, nay, more, that in the whole of these settlements yet examined, not half a dozen human skeletons[1] have been found, contradicts the supposition of a battle having taken place between the aborigines and the supposed conquerors, and of the destruction of the former by the latter. The reason why so many stone and bone implements, not only broken and useless but also in good condition, are found on the sites of the lake dwellings, may be explained simply by the fact that the colonists, when, either from the burning of their houses or from some other cause, they were obliged to settle on the mainland and erect new abodes, would hardly have given themselves the trouble of collecting out of the mud all the celts and other implements which the archæologists are now searching for with such avidity. The fact that nearly every ancient lake dwelling has either a larger or smaller village corresponding with it on the shore, and still existing, seems to indicate these fresh settlements of the population both of the stone and the bronze ages.

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[1] Many traits in this picture are correct, and are based on facts published by me in my own reports, which have been entirely swallowed up (in toto verschluckt) by the 'Habitations lacustres.'

[2] The large number of vessels with remains of burnt corn, and more especially the small quantity of animal bones, show the prevailing use of vegetable food in the lake dwellings of the stone age, for instance, in those of the Unter See.

It is not easy to make out what is the actual definition in this volume of the term 'transition period.' According to the theory brought forward, certain lake dwellings, such as Meilen and Concise, must have procured bronze implements by friendly intercourse with the new comers, and yet, notwithstanding this barter, were destroyed by the intruders.

The hypothesis that it was the most ancient population, and not the conquerors with bronze arms who rebuilt the burnt lake dwellings, must have been suggested merely because it is hardly to be supposed that the new people, who were much further advanced and totally different in culture and manner of life, would have settled down in the very places they had burnt, and erected lake dwellings anew.

Second period.—The assertion that 'Europe has never known an age of copper' may be tolerably correct (see page 363) with respect to Western Europe, but by no means so for the Eastern portion. Plate CXX. gives sketches of a number of copper implements which have been found in the district of the Danube.

By the general use of better bronze implements a notable change doubtless took place in handicraft ability which would have a decided effect on the general condition of the settlers; but we should like to know on what is grounded the assertion that 'the preparation of leather, the art of weaving, and the making of garments took a considerable start,' for at the time when the volume in question was drawn up not a single thread had been found in the bronze settlements of Western Switzerland, nor any trace of leather.

If it be asserted that the population during the bronze age in Western Switzerland was different from that which at the same time settled on the mainland in Eastern Switzerland, let the remains of civilisation in the settlement of Ebersberg given in Plates CXLIII., CXLIV., and CXLV. be examined and compared with those of Nidau Steinberg, and the comparison will afford a convincing proof of the complete identity of the industrial products of both settlements.

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[1] Since this was written a few more human remains have come to light in the lake dwellings, but still the whole number is surprisingly small.—[Tr.]

The statement respecting the period to which the moon-images belong is quite erroneous, as these objects of civilisation do not occur in the iron age, but are quite peculiar to the bronze period. Again, the closest investigation has not as yet afforded the smallest information as to how the lake settlers buried their dead. If it be affirmed that the people of the bronze age introduced the custom of burning their dead, this is directly contradicted by the fact that in all the graves of our district known to us of this period, and in which bronze implements are met with, the remains of the body show that it was not burnt.

Third period.—The work in question then goes on to state that the lake dwellings were burnt down a second time; and in this case by a people armed with iron weapons, pouring down from Southern Germany. According to the very accurate observations of Colonel Schwab, probably about a quarter of the lake dwellings in the lakes of Bienne and Neuchâtel show traces of fire, a proof that a sudden and general destruction of all these settlements is out of the question. There is certainly something striking in the presence of so many bronze implements in the ruins of the lake dwellings, more especially as no small number of them remained occupied in the Helvetian and Gallo-Roman times. The existence of implements of very different kinds in the area of their abodes could not have remained unknown to the inhabitants, and they would certainly have dredged them up if the value of these objects had been worth more than the time and trouble of obtaining them. Who can say whether this may not have actually happened, and whether the specimens now remaining to us may not be simply the gleanings? If we reckon up all the bronze implements yet found—the swords, the javelins, the knives, the celts, the rings, &c.—and divide these objects amongst all the lake dwellings yet examined, the number of these specimens will appear quite inconsiderable for the quantity which must have existed if all the lake dwellings had been suddenly destroyed, and for the most part abandoned.[1] And it must be borne in mind that at the present moment the search for antiquities is carried on with great energy with all kinds of apparatus, such as 'nippers' and mud-machines, and at a great expenditure of time and labour.

With respect to the name and ethnographical determination of the people who lived partly in lake dwellings and partly on the mainland, and who at first made use of stone implements, and consequently are considered as aborigines, anyone who has a fancy may object to their having any relationship with the Celtic element, and attribute to them a Finnish or Iberian origin, or connect them with the race of men discovered by

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[1] A complete inventory of the bronze implements in the collection of Colonel Schwab now lies before me, comprising more than three-fourths of all the bronze articles found in West Switzerland, and also nearly a perfect catalogue of those in other collections.

Boucher de Perthes—thus far is certain, that they do not differ in the smallest degree, either in their abilities, their manner of life, or their industrial attainments, from the people who were provided with metals; but that in the whole phenomena of lake dwellings, from their very beginning to the end of their existence, a gradual, quiet, peaceful development may be observed. The traces of conflagration, and the presence of so many implements amongst the remains of the lake dwellings by no means contradicts this position, for was there ever a village of straw-roofed huts which during some centuries of its existence has not been burnt down either by accidental calamity or in the course of intestine quarrels?

From what has been said, it appears certain that there is no foundation for the hypothesis that the inhabitants of the lake dwellings are to be separated into distinct races, because in the earliest times they had no metal implements, and in later times they possessed them. Nothing can be more true than the remarks of Dr. Lindenschmit, respecting such suppositions, as to the change of nationalities based simply on a difference in implements. 'The simple exchange of material,' he says, 'the transition from the use of stone to that of metal, is in itself not a sufficient ground for inferring a change of population. It is not so important as the change from the spear to firearms; and if at every advance of this kind an entire change of population were to be supposed, the history of civilisation would only have to relate the migrations of nations.[1]

With respect to the immigration of the Celts into Europe, this event belongs to the primitive history of the peopling of our part of the world, and is shrouded in impenetrable darkness. No tradition speaks of the Celts pressing forward towards the countries in the possession of which we subsequently find them, though the Druids, on the other hand, taught that the Gauls were aborigines. At the very first appearance of historical[2] narrative they appear in the far west of the Iberian peninsula, and afterwards as the first amongst the great northern nations which pressed forward eastward from their homes in the west. Now, if it is a fruitless labour in archæology to determine the time of their arrival in Europe, it must be considered as entirely an idle pastime to speak of the degree of civilisation then possessed by this people, who in later times spread over the whole of Central Europe, and still more so to affirm that, at the time of their immigration, they had a perfect knowledge of bronze—understood the mixture of copper and tin so as to produce a harder material, and were thoroughly acquainted with the art of casting.

No less venturesome is the assertion that the Helvetii conquered the land with iron weapons and burnt down the lake dwellings, because they had no lakes in their country, and did not understand this manner of life; and all this at a time when bronze in great quantities was spread over the country, and this peculiar kind of settlement had reached its highest state of development. They are said to have immigrated when hardly any iron implements were to be found in the lake dwellings. But the immigration of the Helvetii is an event belonging to tradition, and it is perfectly impossible to fix its date. It is evident from the history of the Celtic tribes living east of the Rhine that, when pressed by the Germans, they left their own country, and that the Germans laid it waste and afterwards left the Helvetii no rest even in their new abodes.[1] But there is not the slightest information given whether the Helvetii left their homes from necessity or were influenced by the desire of conquest, nor in what relations they stood with the Gallic race on this side the Rhine.[2] But granting that they passed the Rhine as conquerors, how is it possible to suppose that they were perfectly equipped with iron implements when their neighbours on this side the Rhine were without them, and that at a period when the most active exchange was going on, as is clearly shown by the spread of exactly similar bronze implements over Central Europe? Can it be imagined that the race living between the Rhine and the Black Forest had surpassed in civilisation the people who lived on this side of the Rhine, whose country lay open to the influence of the civilised lands on the shores of the Mediterranean, by the paths of the Alps and the valley of the Rhône, as may be proved by the bronze implements brought from those parts? It is a pity that when the volume of 'Habitations lacustres' was compiled, the large number of lake dwellings containing Roman implements were not known; had they been so we should doubtless have had a third conquest of the country—that of the Alemanni—a fresh conflagration of the lake dwellings, and a decimation of the population as a final close to the drama.

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[1] Lindenschmit, 'Die vaterländischen Alterthümer,' p. 159.

[2] Herodotus, iii. 33, iv. 49. Zeuss, 'Die Deutschen,' p. 160.

We cannot here enter on an examination of the picture given of the graves said to have been erected by the lake settlers on the shores of the lake of Geneva, and of the Helvetian manner of living and industrial powers, in which everything is detailed, belonging to the Gallic and Gallo-Roman periods; we can, however, give our assurance that in this chapter, as in many others, right and wrong, relevant and irrelevant are mixed up together in a confused mass.

The phenomenon of the lake dwellings, so important in the history of civilisation,[3] the time of their first establishment, their original design, their development, and their final extinction, in spite of many accumulated facts, is in many respects clouded in doubt. Whether we may consider the first settlers as a branch of the Celtic race who spread over Europe in the earliest times, and were already acquainted with agriculture, can neither be affirmed nor denied with certainty. The extremely simple tools of the oldest lake dwellings exhibit a striking contrast to the productions of their industry and agricultural activity. It is certain from the very beginning of this peculiar mode of living to the latest period of its existence, while outward circumstances remained the same, a quiet advance to a better development of the conditions of life may be observed, in which there was neither retrogression nor any sudden advance by the intervention of foreign elements. The general diffusion of metals in a country which had none is explained simply by the barter which existed throughout Europe in the very earliest ages. The question why the inhabitants of a lake dwelling of the stone age abandoned their settlement, while those of another, not many hours' or many minutes' walk distant, remained quietly living on their platforms, is of no greater importance than the inquiry why, during the middle ages, so many localities have disappeared, the names and situations of which are known to us. The presence of objects of industry on the area of the lake dwellings has nothing in it very surprising, if we consider what misfortunes villages of straw-covered huts were exposed to, in which not only the houses themselves, but even the platforms on which they stood, were formed of very combustible materials. It is possible, if we are to take Cæsar's account literally, that when the Helvetii, whose arrival in the country is neither mentioned in history nor shown by archæology, withdrew, the lake dwellings then existing were, as a whole, burnt down; but there can also be no doubt that some remained standing, or were rebuilt after the return of the population. Their continuing down to the Roman time is only astonishing to anyone who imagines that at this time the whole population had gone over to the Roman manner of life, while the proof lies before him that the lower class adhered to their own manners and customs till the entrance of the German races.

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[1] Cæsar, i. 1.

[2] See pp. 262 and 263.

[3] M. Jayet has lately shown in the 'Bulletin de la Société Vaudoise des Sciences Naturelles, 1862,' that the calculations of the age of the lake dwelling at the foot of Chamblon near Les Uttins, not far from Yverdon, is incorrect.

As before mentioned, notwithstanding all the investigations which have hitherto been undertaken, there is very much in this field of inquiry yet to be explained: nay, even the rapid accumulation of material increases the difficulty of a satisfactory conclusion; but it is very much to be regretted, if the ideas we form of these discoveries (which we are still far from understanding as a whole) should, by venturesome hypotheses, by artificial combinations, and by arbitrary interpretation of facts, be clothed with a poetic mantle, which the sober and conscientious observer may find it difficult to throw off, as the greater proportion of antiquaries, especially the foreign ones, are not thoroughly acquainted with the actual facts of these phenomena, and of their relation to the other antiquities of Switzerland.

APPENDIX B.

PILE DWELLING IN THE LAKE OF HALLSTATT.[1]

ON A PILE DWELLING ON THE NORTHERN SHORE OF THE LAKE OF HALLSTATT. BY HERR BERGRATH STAPF.

The northern shores of the Lake of Hallstatt at Obertraun and Steeg (spelled Steg in many maps) have often been examined in the hope of finding the remains of pile dwellings, but hitherto without success; partly because the lake becomes suddenly deep near the shore, and partly because the water of the lake was dammed up by the formation of a sluice made at Steeg, where the river Traun runs out of the lake.

This sluice was made in the latter part of the fifteenth century and the beginning of the sixteenth, the object being to regulate the supply of water required for the vessels which carry away the salt. Before it was constructed there was here a foot bridge (or *steg*) over the river Traun; hence the name of the place.

By means of this sluice the level of the water in the lake became four or five yards higher, and, consequently, the ancient shores were more or less overflowed, and any chance remains of pile dwellings apparently stood further in the lake, where they were less likely to be looked for or noticed.

The sluice at Steeg is repaired every winter, as well as the works which protect the banks at the river Traun, and at these times, the water being lowered as much as possible, the level sinks two or three yards. Not long since, in February, when the level of the water had been thus reduced, a pile dwelling was discovered about 380 yards above the sluice at Steeg, and at a distance of 164 yards from the northern shore, just opposite to the estate called Seeau.

This settlement is square, being about thirty-three yards long and the same in breadth. The piles are about a yard apart, and when the water is low they are about a yard below the surface.

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[1] Of all the lakes which have come under my notice that of Hallstatt appeared the most unlikely to contain remains of pile dwellings. It was therefore with no common interest that, a few weeks ago, when at Hallstatt, I heard from Herr Bergrath Stapf (the Government officer of the salt district there) that piles had been discovered at the northern extremity of the lake, where the water is comparatively shallow. He showed me one or two piles which had been drawn up, but I must confess that they appeared to me of comparatively late age. He also showed to me masses of the mud brought up from the bottom, which contained a large number of pieces of charcoal. The following day he kindly took me in his boat to the locality above mentioned, and showed me a number of the piles projecting from the lake-bottom. There can be no doubt about the former existence here of a pile dwelling, but further investigation is necessary before its age can be determined. From the appearance of the piles which had been extracted, I came to the conclusion that the erection was comparatively of late date; but the notices of one or two settlements in the present volume show plainly that *every* pile dwelling is not of very high antiquity. I believe that Mr. Bergrath Stapf agrees with me, or very nearly so. The above is almost a literal translation of the account of this settlement, which he kindly sent to me since my return to England.—[TR.]

Within the first row of piles there is a second row, also about a yard from each other and from the first row.

Many of the piles are hidden by the large number of water plants which grow up and cover the surface of the water.

The actual lake dwelling is situated within these two rows of piles; it is square and at a distance of about eight yards from them.[1]

The settlement was supported by seventy-two piles placed in nine rows each of eight piles.

I had some of the piles drawn up, and noticed the following peculiarities:—Three different colours may be remarked upon them. That part which had been driven into the lake-bottom retained for about two yards the usual colour of the wood. Above this, for about two yards and a half, the colour is dark grey, occasionally almost black, while above this, for about a yard and a half, the colour is still grey, but occasionally passes into a brownish tint.

The last-mentioned part was in the water: the other two were covered by the ground of the lake-bottom.

The lower part of the pile, or that which was in the lake-bottom, is in very good preservation, and is thicker than the upper portions. The top terminates in a blunt point. The upper parts are not so round as the lower, being more or less worn away: in fact, they have become thinner either by the action of running water or by the wood or ice which has been driven against them.

From the above facts it might possibly be considered that the lower part of the pile, or that which had been driven into the ground, was the thickest, but this was not the case.

The lower ends of the piles appear to have been pointed by a tolerably sharp implement. It cannot be decided whether they had been cut off at the upper end with a saw, for not a trace of the action either of saw or axe was here visible.

The piles are about six yards and a half long, and from nine to thirteen inches thick. No bark was to be seen upon them.

From one-third to three-fourths of an inch on the outside the wood is more or less soft, and is of a greyish-white colour, becoming darker towards the centre.

From the sap to the heart the wood is in good preservation, and is very firm. Apparently it is larchwood.

As above mentioned, the level of the lake has been raised by the formation of the sluice at Steeg, and this may explain the different colours on the piles. It is very certain that they had not been driven into the ground four or five yards, but at most two yards, and this may account for the wood having retained its colour for that length.

The darker colour of the middle portion of the piles may be explained by the lake-bottom having been raised around the settlement two yards and a half, either by the charcoal and refuse thrown away by the inhabitants, or by the natural accumulation of mud, wood, &c., which was certain to be increased when the level of the water was raised.

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[1] If these measurements are to be considered strictly accurate, the lake dwelling itself must have been a very small one.—[Tr.]

This second bed of mud, two yards and a half thick, may therefore be taken to represent the duration of the settlement.

I had the lake-bottom examined by a boring tool, and we obtained several kinds of mud mixed with charcoal and other organic remains, such as wood, a hazel-nut shell, remains of molluscous animals, &c.

I could not continue my investigations, as the season was commencing for shipping off the salt, when the sluice is closed and the level of the water consequently becomes much higher; neither had I the requisite tools and apparatus.

The question whether this settlement belongs to the age of the lake dwellings or to a later period cannot therefore be definitively settled until further investigations have been undertaken.

APPENDIX C.

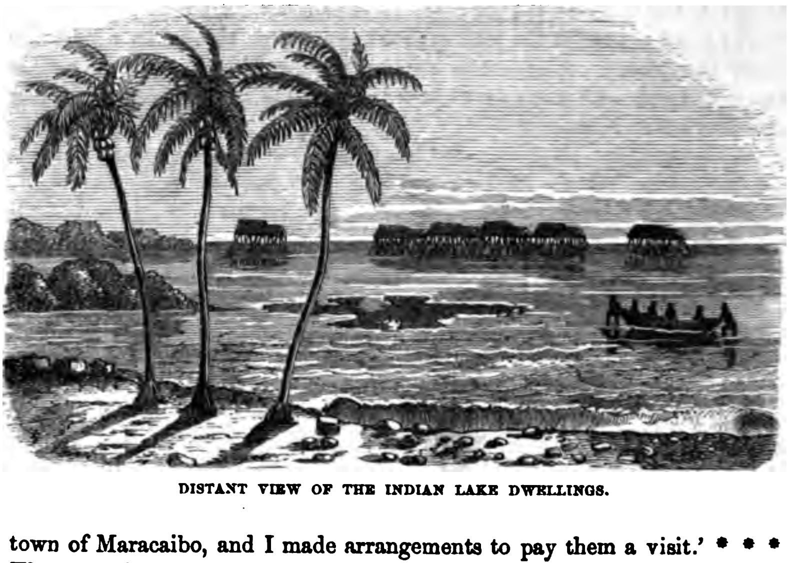
MODERN LAKE HABITATIONS, GULF OF MARACAIBO.

BEING AN ACCOUNT OF A VISIT TO THE GUAJIRO INDIANS OF MARACAIBO, BY A. GOERING, ESQ.

[Extracted and condensed from *Illustrated Travels*, vol. ii. pp. 19–21.]

'Whilst at Maracaibo I took great interest in a tribe of Indians who inhabited this region, the above-mentioned Guajiros. A few half-civilised families of this singular people are settled in the neighbourhood of the town of Maracaibo, and I made arrangements to pay them a visit.' * * * The wary Indians soon perceived us, and two men put off in one of the rude boats, formed simply of the trunk of a tree hollowed out, and called *cajucos*. On landing, they asked what we had come for. A few presents

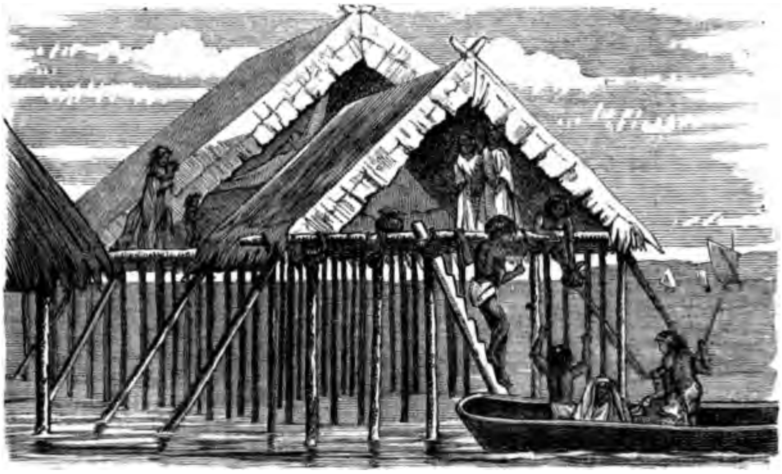
FIG. 47.



DISTANT VIEW OF THE INDIAN LAKE DWELLINGS.

which we had brought, and the fact, which Indians are quick to perceive, that we were not Spaniards or Venezuelans, prepared the way to a friendly conversation, which ended in the men consenting to gratify our curiosity to see their marine village by taking us over. The water shallowed off very gradually near the shore, making the embarkation difficult; but this was overcome by the Indians taking us, one by one, on their shoulders and carrying us to the boat. Once embarked, we were obliged to crouch down in the bottom of the *cajuco*, and remain motionless, the least movement threatening to capsize the crazy vessel. The Indians stood one at each end, and propelled the boat by means of long poles. In this way we progressed pretty rapidly, but we occasionally got aground, and then our guides had to jump in the water and shoulder us over the obstruction.

FIG. 48.



VIEW OF ONE OF THE LAKE DWELLINGS OF THE GUAJIRO INDIANS.

'In this way we reached the Guajiro village. Here a lively scene presented itself. The houses, with low sloping roofs, were like so many little cock-lofts perched on high over the shallow waters, and they were connected with each other by means of bridges, made of narrow planks, the split stems of palm trees. As we approached, a crowd of women, apparently trying to get within their own doorways so as to be able to peep freely from within shelter at their unwonted visitors, * * * We were invited to enter one of the huts. To do this we had to perform a feat worthy of some of the monkeys in the neighbouring woods, for we had to climb an upright pole by means of notches cut into its sides.

'Each house, or cock-loft, consisted of two parts, the pent-roof shelter being partitioned off in the middle; the front apartment served the double purpose of entrance-hall and kitchen, the rear apartment as a reception and dwelling chamber, and I was not a little surprised to observe how clean it was kept. The floor was formed of split stems of trees, set close together and covered with mats. Weapons and utensils were placed in order in the corners. * * *

'Villages composed of pile dwellings, such as that I have here attempted to describe, and of which the engravings give a faithful representation, are numerous along the shores of the great "Lake" or Gulf of Maracaibo. The positions chosen for their erection are near the mouths of the rivers and in shallow waters. The piles on which they rest are driven deep into the oozy bottom, and so firmly do they hold that there is no shakiness of the loftily-perched dwelling perceptible, even when crowded with people. The advantages of dwelling in houses so situated, in a hot climate like this, are very great. The inmates received the full benefit of the refreshing breezes, whether from land or sea, which temper so agreeably the sweltering heats of tropical America; and as they pursue their indoor avocations they are soothed by the continual murmur of the waters beneath. It is like living aboard ship, with the advantage of solid footing and facilities of going ashore whenever one wishes. Pile dwellings, more or less similar to those of Maracaibo, are found in other parts of South America; generally, I believe, about the mouths of the Orinoco and the Amazons. They are the invention not exactly of savages, but of tribes of men in a very primitive stage of culture. Such, probably, were the people who lived in the prehistoric lake dwellings of Switzerland.'

APPENDIX D.

STONE IMPLEMENTS IN AFRICA (see note, page 18).

On this subject a good deal of light has been thrown by Doctor Giuseppe Belucci, who, in 1876, published a short treatise under the title of 'L Eta della Pietra in Tunisia' (Roma: Giu. Civelli). This little work gives a small map of the neighbourhood and two plates of drawings of the flint implements found in the district. These specimens correspond in almost every case with those of Europe. Numbers of burnt bones were also found with them. Numerous flint chips or refuse occurred, and also some of the nuclei from which the implements had been struck off. It may be well to add that these specimens are found not only on the surface but at a depth varying from a foot to more than two feet below it.

STONE IMPLEMENTS FROM THE CAPE OF GOOD HOPE.[1]

Mr. George Busk, F.R.S., gave some account of a large series of stone implements from the Cape of Good Hope, sent to him by his brother Mr. C. J. Busk in 1867, and of a smaller series received from Dr. Langham Dale, from 'the flats' near Cape Town.

They consist of arrow-heads, spear-heads, and scrapers, native pottery, and a perforated stone. The flakes are of the usual form with a bulb of percussion at one end. Stone cores were also obtained by Dr. Dale. They were all collected between Table Bay and False Bay.

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[1] 'International Congress of Prehistoric Archæology.' Norwich: 3rd Session, 1868. London, 8vo, 1869, pp. 69-79, with a plate.

The specimens sent by Dr. Dale were mostly of quartzite with a saccaroid fracture. Stones used for rubbing and pounding had also been collected by Mr. C. J. Busk, as well as arrow-heads and scrapers.

Mr. T. Baines, the well-known African traveller, had informed Mr. Busk by letter, that in 1855 he had first seen spear- or arrow-heads of stone dug up by Mr. Bowker near the Fish River, in the Eastern province, 18 feet below the surface.

Mr. Edgar L. Layard, Curator of the Museum at Cape Town, has also collected them, and a large series are now in the British Museum.

Mr. John Evans, F.S.A., mentioned that similar implements had also been found as far east as Graham's Town. The majority were of quartzite, but some had the appearance of being made of jasper. They were all of very simple form, made with a single blow, one side flat, the other having two or more faces.

Mr. E. B. Tylor, F.R.S., said that a few years ago Africa was considered an exceptional country as regards the use of stone implements.

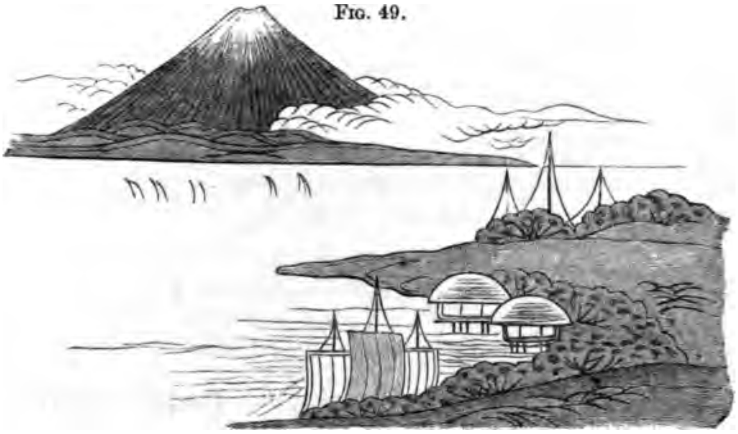
Mr. Prichard said that the first inhabitants of Africa must have had a knowledge of iron as there was no trace of a stone age there. That this idea was entirely wrong they were now aware.[1] He considered it probable that these implements might have been used by the Zulus. Colonel Lane Fox, Mr. Howorth, and others took part in the discussion.

APPENDIX E.

JAPANESE PILE DWELLINGS.

My friend Mr. Henry Woodward has sent me a copy of a native drawing, if it may be called so, of a species of lake habitation used in Japan; and although there is something ludicrous in the idea of the source from which it was derived (as it was copied from a *tea-tray*!), yet this very fact

FIG. 49.



MODERN PILE DWELLINGS, AS NOW IN USE IN JAPAN: FUSI-YAMA, THE SACRED MOUNTAIN OF JAPAN, SEEN IN THE DISTANCE.

---

[1] 'Early History of Mankind,' by E. B. Tylor, p. 219.

argues in favour of the frequent occurrence of such structures in that country. I have therefore thought it worth while to give a small woodcut showing these pile dwellings. Singularly enough they appear to have been circular.

The distant volcanic cone of Fusi-yama, the loftiest and most regular of the Japanese volcanoes, makes, as is usual in their pictures, a striking object on the horizon.—[Tr.]

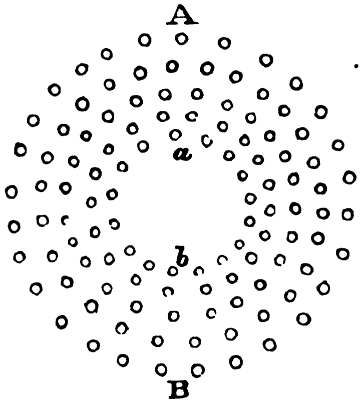
APPENDIX F.

CIRCULAR PILE DWELLING IN THE LAKE OF MORAT.

Dr. Keller's opinion has always been adverse to the idea of lake dwellings having been circular. It was therefore with some surprise that on the 15th November I received from him a postcard giving me information of the discovery of a circular pile dwelling. It would be highly desirable if all scientific men were as candid as he is. The very last item in his valuable work seems to go contrary to one of his long-cherished ideas, but he at once communicates the information: facts and facts only form the platform of science. As his letter on the postcard contains only two or three lines, it is here copied verbatim:—

'A circular pile dwelling on a small island, at Fang, in the lake of Morat.

Fig. 50.



'From A to B is 44 yards.

'From *a* to *b*, 7½ yards.

'The rings of piles are about a yard apart. The piles consist of split oak.—Zürich, 12 Nov. 1877.—F. K.'

APPENDIX G.

NOTES ON 'JADEITE' AND 'JADE.'[1]

BY THOMAS DAVIES, ESQ., F.G.S., OF THE DEPARTMENT OF MINERALOGY, BRITISH MUSEUM.

JADEITE (Damour).

Specific gravity 3·28 to 3·4; hardness 6·5 to 7. Colours milky-white, with bright green veins and splotches, greenish grey, bluish-grey, clear grey and translucent as chalcedony, orange-yellow, smoky-green passing to black, apple-green, sometimes emerald-green, all the green tints as a rule much brighter than in the oriental jade, also, but rarely, of violet shades. Texture from compact, to crypto-crystalline, and distinctly crystalline, sometimes coarsely so; fibro-lamellar, opaque to translucent and sometimes transparent.

Thin splinters will fuse in the flame of a spirit lamp. Damour, from analyses made by him, suggests its affinities to the epidotes.

Localities.—Central Asia, and particularly China; also as articles worked by the Aztecs, Mexico.

ORIENTAL JADE (Damour).[2]

Specific gravity 2·96 to 3·06; hardness 5·5 to 6·5. Colours white and white variously tinted, greenish-grey, many shades of green. Texture mostly compact, rarely crypto-crystalline.

Found chiefly in Central Asia, particularly in China and on its borders. Also in New Zealand and the Pacific Islands generally.

Specific gravity of upwards of 100 specimens from New Zealand determined by myself have been within the limits of 3·00 to 3.02, by far the larger number giving 3·01.

OCEANIC JADE (Damour).

Specific gravity 3·18; hardness 5·5 to 6·5. Of this variety I possess no personal experience, the large number of objects of jade which have come under my observation not having yielded me one example. Damour, however, who examined four specimens, states that in its aspect and general characters—with the exception of its density—it much resembles the oriental jade. It, however, possesses a somewhat silky lustre, due to exceedingly delicate fibres which traverse the mass. I have met with this structure frequently, however, in the jade from New Zealand, which possessed the density of 3·01. From an analysis Damour refers it to the pyroxene group, whereas the oriental is referable to hornblende.

Found in New Caledonia and Marquise Island, Pacific.

None of these minerals to my knowledge have been met with *in sitû* in Europe, though the British Museum possesses a fragment of unworked oriental jade purporting to have been found in Turkey.

---

[1] I am indebted to the kindness of Mr. Thomas Davies for transmitting me the above note on 'Jadeite' and 'Jade,' which may prove acceptable here.—[TR.]

[2] Damour makes the old name 'nephrite' a synonym of both oriental and oceanic jade, the term nephrite being now generally abandoned by mineralogists.—T. D.

APPENDIX H.

DISCOVERY OF PILE DWELLINGS IN FINSBURY, LONDON.

A friend has just reminded me that Colonel A. Lane Fox, F.R.S., F.S.A., has given[1] an account of the discovery of the remains of successive pile villages in the peaty marsh where Finsbury now stands, outside the city walls, where in Romano-British times some outcast natives lived.

APPENDIX I.

Note.—As several of the lake-dwelling stations have different names in French and German, it may be advisable to append the following list of synonyms:—

French.	German.
Bienne.	Biel.
Douanne.	Twann.
Estavayer.	Stäffis.
Gérofin.	Gerlafingen.
also,	Oefeli (lower station of Gerlafingen).
Locraz.	Lüscherz.
Morat.	Murten.
Neuchâtel.	Neuenburg.
Neuveville.	Neuenstadt.
Chavannes.	Schaffis.

ADDENDA AND ERRATA.

By some mischance the specimens drawn on the following plates have not been described in their proper places:—

Pl. XLVI.	Fig. 1.—Bronze sword, Estavayer.
Pl. XLVII.	Fig. 1.—Bronze sword, Concise.
	Fig. 2.—Bronze sword, Forel.
Pl. LIII.	Figs. 2, 3, and 4.—Bronze cutting implements, Auvernier.
Pl. LVIII.	Fig. 6.—Bronze pendant, Auvernier.
Pl. LIX.	Fig. 15.—Bronze pliers, Möringen.
Pl. LXV.	Fig. 2.—Bronze armilla, Auvernier.
Pl. CVIII.	Fig. 6.—Socketed celt, Lake of Bourget.
Pl. CLVIII.	Fig. 5.—Wooden spindle staff, Lake of Bourget.

Page 172, line 8 from the bottom, *for* 'a near pendant' *read* 'an ear pendant.'
Page 455 (note), line 3 from the bottom, *for* 'von Lacken' *read* 'von Sacken.'

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[1] 'Anthropological Review,' April 1867, No 17. p. 71.

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